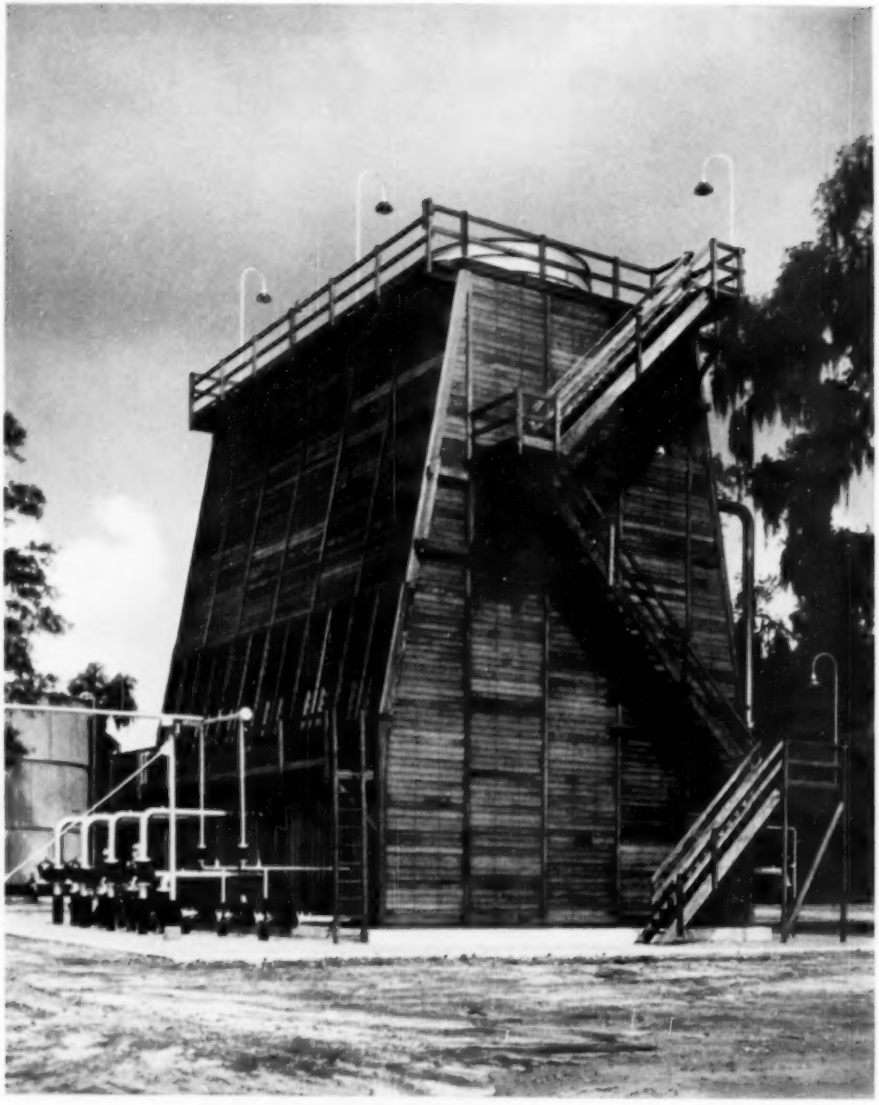
APRIL, 1950
VOL. 5, NO. 4

PETROLEUM PROCESSING

OUTLOOK FOR GAS LIQUIDS INDUSTRY

A Petroleum Processing Survey--p. 373



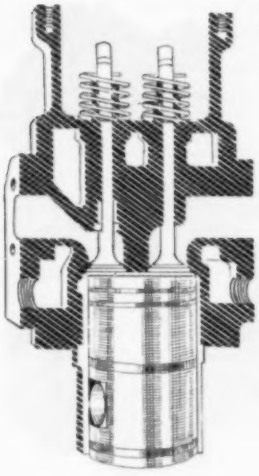
HUDSON
Top Performance
COOLING TOWERS

Beauty and utility have been combined in the new TP design. These Top Performance Towers, embodying new but proven advancements in water cooling design, result in lower installation and operating costs, and assure guaranteed performance.

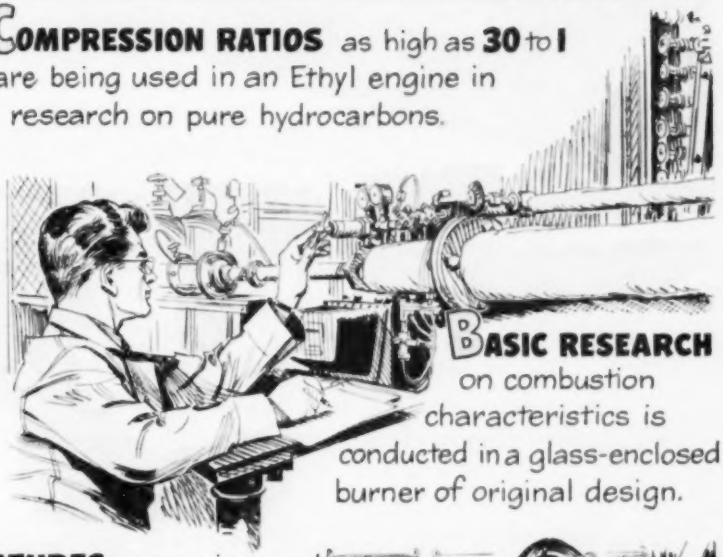
HUDSON ENGINEERING CORPORATION

FAIRVIEW STATION — HOUSTON, TEXAS

Technically Speaking... by ETHYL

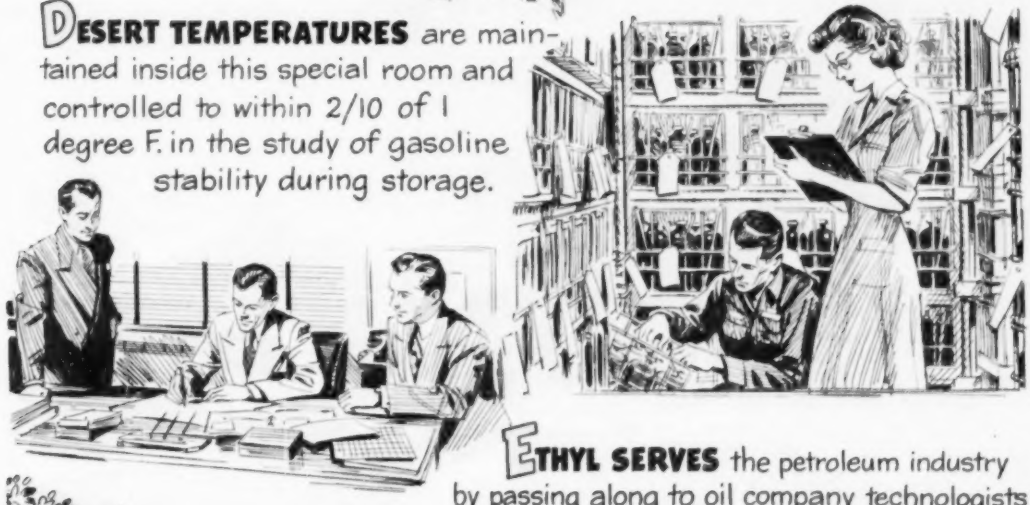


COMPRESSION RATIOS as high as **30** to **1** are being used in an Ethyl engine in research on pure hydrocarbons.



BASIC RESEARCH on combustion characteristics is conducted in a glass-enclosed burner of original design.

DESERT TEMPERATURES are maintained inside this special room and controlled to within 2/10 of 1 degree F. in the study of gasoline stability during storage.



ETHYL SERVES the petroleum industry by passing along to oil company technologists information secured from Ethyl research projects.

Since 1923—*continuous research to provide better antiknock service*

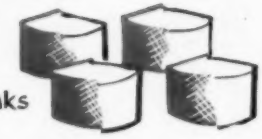
ETHYL CORPORATION
RESEARCH LABORATORIES

Detroit, Michigan
1600 West Eight Mile Road

San Bernardino, California
2600 Cajon Road

[To obtain more data on advertised products see page 424]

Easy Lesson in CONSERVATION ECONOMICS

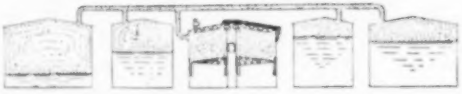
If you have several cone roof tanks 

that can be interconnected,

you can convert breathing losses and filling losses

into profits quickly. Field studies at a typical gasoline plant

show $aving$ of more than 5,000 gallons a week when six cone roof

tanks were hooked up  with a

Wiggins DRY SEAL Gasholder. Including expenses,

amortization took less than 20 months. What's more,

the Wiggins 100% DRY SEAL cuts out rain

and snow maintenance problems.

GENERAL AMERICAN
TRANSPORTATION CORPORATION
135 South LaSalle Street, Chicago 90, Illinois

District Offices: Buffalo • Cleveland • Dallas • Houston
Los Angeles • New Orleans • New York • Pittsburgh
St. Louis • San Francisco • Seattle • Tulsa • Washington

Export Dept., 10 East 49th Street, New York 17, New York

Send for Full Data on the Wiggins Dry Seal Gasholder. Also—without obligation—ask for a "Pay Out Analysis" of your storage set-up.

PETROLEUM PROCESSING

Covering petroleum research and the design, management, operation and maintenance of plants processing hydrocarbon materials into fuels, lubricants and chemicals

1213 West Third St., Cleveland 13, Ohio

A Platt Petroleum Publication

ABC

WARREN C. PLATT, *President*
ALBERT W. BOULTON, *Vice President*
A. E. KRAFT, *Treasurer*

EDITORIAL STAFF

VIRGIL B. GUTHRIE, *Editor*
WILLIAM F. BLAND, *Engineering Editor*
WILLIAM C. UHL, *Equipment Editor*
PETER J. GAYLOR, *Patent Reviewer*
D. P. THORNTON, Jr., *Southwestern Editor*
901 World Bldg., Tulsa 3, Okla.

Editorial Affiliates

PAUL WOLLSTADT, *News Editor*
H. A. YOCOM, *Washington Bureau Chief*

ADVERTISING SALES STAFF

F. GLENN MORRIS, *Manager*

Regional Representatives

NEW YORK 20, NEW YORK
P. S. Carberry, 50 West 50th Street

PHILADELPHIA 3, PA.
C. J. Jefferis, 135 South 17th Street

CLEVELAND 13, OHIO
K. W. McKinley, 1213 West 3rd Street

CHICAGO 5, ILL.
R. D. Henriquez, 59 East Van Buren Street

HOUSTON 2, TEXAS
George Reid, 320 First National Bank Bldg.

SAN FRANCISCO 4, CALIF.
Robt. W. Walker Co., 68 Post Street

LOS ANGELES 5, CALIF.
R. W. Walker, 684 S. Lafayette Park Place

Published second Tuesday of each month by National Petroleum Publishing Co., 1213 West Third St., Cleveland 13, Ohio. Subscriptions: $3.00 a year in U.S. and possessions, $3.50 a year elsewhere. Single copies, 35 cents each; back copies more than three months old, 50 cents each. Published prior to Sept., 1946, as the *Technical Section of National Petroleum News*, devoted to Refinery Management and Petroleum Chemical Technology, and including *International Petroleum Technology*. Trade mark registered U.S. Patent Office. Copyright 1950 by National Petroleum Publishing Co. Acceptance under the act of June 5, 1934, at Cleveland, Ohio, authorized Dec. 22, 1948.

VOL. 5, NO. 4 APRIL, 1950

Contents

FEATURE ARTICLES

Platforming—Operating and Design Details, by *William F. Bland* 351

Platforming—Chemical Reactions, Operating Variables, Product Properties, by *Vladimir Haensel* 356

Graphic Panels—The New Look in Instrumentation by *William C. Uhl* 361

API Refining Division Committees Report on Their 1949 Activities 369

Outlook For Gas Liquids Industry, by *D. P. Thornton, Jr.* 373

Trends in the Design of New Plants For Recovering Liquids from Gas, by *Charles F. Sanderson and Alan S. Glendening* 377

Flare Tip Design 384

Ethylene Production by Cracking of Propane-Ethane Mixtures, *Part 2*, by *C. K. Buell and L. J. Weber* 387

"Information Please" Session Will Highlight NGAA Meeting 394

DEPARTMENTS

What's Happening! 319

Tomorrow in Petroleum Technology, by *B. H. Weil* 325

Plant Practices, Practical Tips and Ideas 397

Equipment Patent Review 401

Patent Trends in Petroleum Refining, by *Peter J. Gaylor* 404

Book Reviews 409

Refining Trends—Current Statistics 415

News of Manufacturers—Suppliers—Engineering Firms 419

Advertiser's Index 424

What's New! Equipment, Material, Processes, Literature, *Reviewed by William C. Uhl* 425

Personals 436

Meetings for the Oil Man 439

Editorial Viewpoints 440

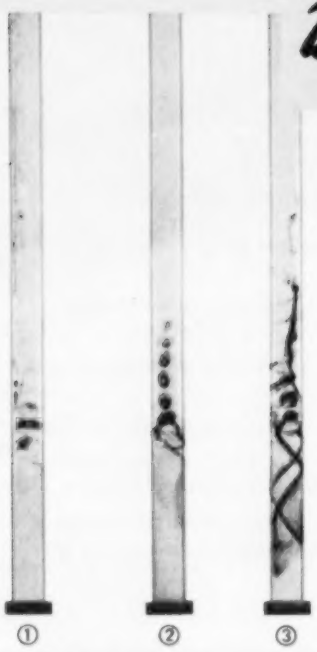
Other Platt Petroleum Publications

PLATT'S OILGRAM NEWS
A daily independent oil-news reporting service issued from New York, Cleveland, Houston

NATIONAL PETROLEUM NEWS
The weekly oil marketing magazine, covering news, prices, transportation, storage, merchandising

PLATT'S OILGRAM PRICES
A daily independent oil price reporting service issued from New York, Cleveland, Houston

Du Pont Announces



Glass manifolds from single cylinder engine showing deposit forming tendency of dye.
No. 1 operated on .5 gram Oil Blue A/100 gal. gasoline
No. 2 operated on 1.0 gram Oil Blue A/100 gal. gasoline
No. 3 operated on .75 gram Oil Blue/100 gal. gasoline
Even No. 2 with higher dye concentration shows less deposit than No. 3 with previous Oil Blue.

A New High Tinctorial Strength Gasoline Dye...

Du Pont Oil Blue A

Developed Especially for Aviation Gasolines

Another new Du Pont product—Du Pont Oil Blue A is a gasoline dye made to meet the need for a blue dye of high tinctorial strength which can be used in lower concentrations to obtain the desired color intensity. Approximately 35% stronger than the previous Du Pont Oil Blue, it is several times more soluble as well. Du Pont Oil Blue A meets the requirements of Specification MIL-F-5572 and may be used in aviation gasolines intended for military use.

Du Pont Oil Blue A is a single component dye with a free flowing crystalline form which will not lump or cake on prolonged storage, even at elevated temperatures. This feature, coupled with its high degree of solubility, simplifies the preparation of stock solutions or the direct dyeing of gasoline.

The deposit forming tendency of Du Pont Oil Blue A in intake manifolds is considerably less than the former Oil Blue as demonstrated by the glass manifolds shown opposite from laboratory bench tests in single cylinder engines. The lower concentration of dye required to meet established color standards helps greatly to minimize deposits.

APPROXIMATE SOLUBILITY—Grams/100 U.S. Gal.	
Straight Run Gasoline	760-950
Thermal Cracked Gasoline	1150-1500
Aviation Gasoline	570-760
Benzene	28400-32000

Dye Changes in Du Pont Tel Compounds, Aviation Mix and Motor Mix

Du Pont Oil Blue A will be used to color Du Pont Tetraethyl Lead Compound, Aviation Mix. In addition, the dye in Du Pont Tetraethyl Lead Compound, Motor Mix, will be changed from yellow to orange, thereby reducing dye solid content by 35%. These dye changes will not require changes in your finished gasoline color formulae.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
...Through Chemistry

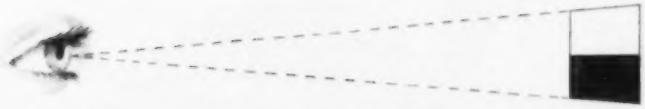
Petroleum Chemicals

Make Du Pont the Source for All of Your Gasoline Additives — Tetraethyl Lead Compounds (Motor Mix—Aviation Mix)—Antioxidants—Metal Deactivator—Dyes

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

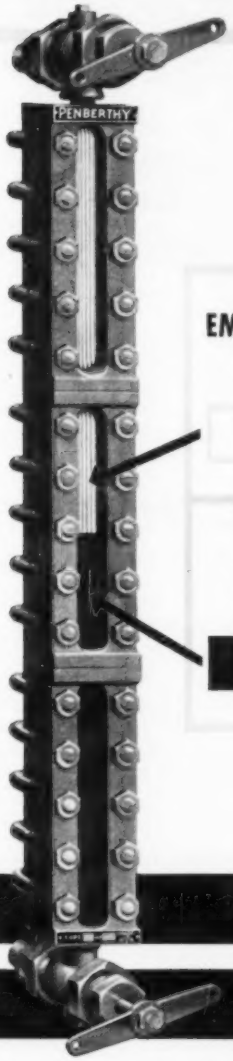
District Offices: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.



YOU CAN READ

the PENBERTHY Reflex GAGE as far as you can distinguish between BLACK and WHITE



There can be no mistake in reading the Penberthy Reflex Gage. Due to the optical effect of the prismatically grooved glass, the liquid always shows black, and the empty space white. This optical effect is unvarying and absolutely sure. As a result, you can read the gage correctly as far as you can distinguish black and white . . . read it at a glance. There is no squinting to see the meniscus . . . the dividing line between liquid and empty space is always sharp and unmistakable.

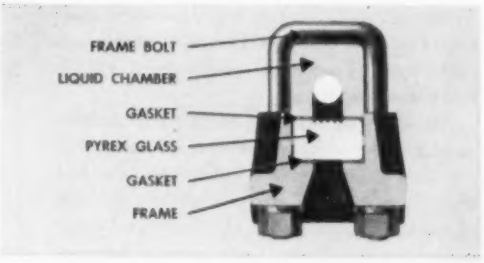
In addition to standard units, Penberthy Reflex Gages are also fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. They conform with API-ASME requirements.

PENBERTHY INJECTOR COMPANY

Established in 1886

Canadian Plant
Windsor, Ontario

DETROIT 2, MICHIGAN



3398

PENBERTHY Reflex

DROP FORGED STEEL • • LIQUID LEVEL GAGES

Time to change your oil, too with **AEROLUBE ADDITIVES**

AEROLUBE* Additives can help you make important changes in your own brands of oil that will enable you to meet the challenge of today's lubrication requirements.

The ability of AEROLUBE Additives to produce maximum detergency, oxidation resistance and corrosion inhibition in regular, premium and heavy-duty oils has been proved through years of service. Proven, also, is the ability of Cyanamid's Sales and Service Department to help motor oil makers select exactly the right AEROLUBE Additives to economically improve the properties of their oils. Let these Cyanamid representatives work with *you* in every possible way.

Other Cyanamid specialties for the petroleum industry include AEROCAT* Synthetic Fluid Cracking Catalysts, AERO** Specialty Catalysts, Gasoline Dyes and Drilling Mud Chemicals. Write today for literature and samples.

*, **Trade-mark

AMERICAN *Cyanamid* COMPANY

PETROLEUM CHEMICALS DEPARTMENT, DIV. C4

30 Rockefeller Plaza, New York 20, N. Y.

WHEN PERFORMANCE COUNTS . . . CALL ON CYANAMID

What's Happening!

Important Current News Summarized for Refiners

EXPANSION

Shamrock Oil and Gas Corp. will install a Houdriflow catalytic cracking unit at its McKee refinery near Sunray, Texas, with completion scheduled for early 1951. Construction will be handled by Catalytic Construction Co. The new unit will have a design capacity of 5900 b/d of fresh charge, with additional capacity to permit recycling for increased gasoline production.

National Cooperative Refinery Assn. will spend approximately $2 million to enlarge and modernize its McPherson, Kan., refinery. Capacity will be boosted from present 18,000 b/d to approximately 22,000 b/d and include a package Fluid catalytic cracking unit, catalytic polymerization, and modernization of existing equipment. Refinery Engineering Co., Tulsa, will supervise construction under license from Universal Oil Products.

Premier Petroleum Co. will revamp the thermal unit at its Ft. Worth refinery within the next few months as the first project in an extensive modernization and enlargement program. Engineering work will be done by company's engineers.

Mexican Petroleum Corp. is planning an asphalt plant of 75,000 tons per year at Wilmington, N. C. Cost of plant is not disclosed but will be considerably less than rumors of $3,500,000. Semi-finished material will be brought by tanker from Texas for processing.

Standard Oil Co. of Calif. will convert its TCC unit at Richmond to Houdriflow, increasing coke burning capacity 60% and catalyst circulation from 150 tons per hour to 500 tons. It will construct a new 50,000 b/d vacuum flasher, to process heavy oil residue from other refining processes at Richmond. Engineering work already has been started on the TCC conversion.

• • •

FOREIGN

Japan's Toa Nenryo Kogyo, Ltd., refinery at Shimizu, southwest of Yokohama, will soon be on stream at the rate of 4,000 b/d and its Wakayama refinery, also owned by Toa Nenryo, is expected to begin operating early next month at 6,000 b/d, according to Standard-Vacuum Oil Co., which bought an interest in Toa Nenryo several months ago. Operations are being started with crude bought from U. S. companies with U. S. military funds. Some crude from sterling sources in North Borneo and Kuwait also will be used, however.

Vacuum Oil Co., Ltd., subsidiary of Socony-Vacuum, will build a complete 20,000 b/d refinery, specializing in high grade lubricating oils, at Coryton, England. Plant, expected to go on stream in about 30 months, will cost $30 million and will treat Middle East crude primarily.

• • •

COMPLETIONS

Standard Oil Co. (Ohio) has completed a 20,000 b/d combination crude distillation and delayed-coking unit at its Lima, Ohio, refinery. This is the second major new unit to be placed on stream in the $30 million Lima construction program, the first being a Fluid cracking unit.

Wood River Oil & Refining Co. has put its 7,500 b/d Fluid catalytic cracking unit on stream at the Hartford, Ill., refinery. Daily capacity at Wood River has been raised to 30,000 b/d with the new unit. Koch Engineering Co. designed the unit under UOP license; Graver Tank and Manufacturing Co. supplied vessels.

• • •

NATURAL GASOLINE

Hiwan Oil & Gas Co., Magnolia, Ark., has formed an affiliated company, Hiwan Petroleum Co., and purchased the pressure tankage and storage facilities at Cotton Valley, La., constructed during the war as an adjunct to the 100-octane refinery built by RFC and operated by Premier Refining Co. Hiwan operates a natural gasoline plant in the Atlanta field near Magnolia.

Shell Oil Co. has announced plans to construct a gasoline-extraction plant in the Elk City field of Beckham and Washita counties, Oklahoma, capacity of 100,000 Mcfd. Plant will be designed to permit

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

adaption for cycling, repressuring, and crude stabilization. Refinery Maintenance Co., Houston, was awarded construction contract and work will start immediately.

Standard Oil Co. of Texas has requested permission of Texas Railroad Commission to dismantle an operating natural gasoline plant in the South Ward oil field, Ward county. Plant, it is said, has become unprofitable.

• • •

MARKETS, PRICES

General price changes were downward in March, and the trend was marked enough to cause some major refiners to express "doubts" about the present crude oil price structure holding, both in this country and abroad.

A reduction of 0.5c per gal. in its tank car prices for all grades of gasoline, and a cut of 0.3c per gal. in tank wagon prices to consumers and resellers, were announced by Standard Oil Co. (Ohio) throughout the state of Ohio, effective March 3.

Toward the middle of the month, Standard Oil Co. (Ind.) made an 8-state reduction in its tank wagon prices for gasoline. The reduction, effective March 14, ranged from 1c to 1.5c per gal. Areas affected were Illinois, Indiana, Iowa, Missouri, Nebraska, Kansas, Minnesota and Wisconsin.

Continental Oil Co. also made cuts ranging from 0.5 to 1c per gal. in its gasoline prices throughout Oklahoma and Colorado, effective March 29 and 30.

Prices for distillate fuel oils eased seasonally. Esso Standard announced reductions up to 0.6c per gal. in its posted prices for heating oils and Diesel oils at a number of Eastern points, effective March 21. Standard Oil Co. (Kentucky) cut back its prices for Diesel oil in tank car lots 0.3c per gal. effective March 27, to 8.8c at Jacksonville, Port Everglades and Savannah, and 8.7c at Mobile, Pensacola and Tampa.

Concern over the general downward slide of product prices was apparent among a large segment of the refining industry, although many refiners pointed out that the nation's stock position was relatively low on all products except gasoline.

Sun Oil Co. in its annual report said: "Clouding the immediate outlook are the unsettled crude oil picture and an intensification of adverse factors in the foreign trade situation."

W. S. S. Rodgers, chairman, and Harry T. Klein, president of The Texas Co. summed up the question of product prices in relation to the price on crude in the company's annual report. "At present," they said, "the price of gasoline throughout the country is weak and there is considerable price cutting. Prices for middle distillates (mostly home heating oils) and heavy fuel oil have been steady during the high-consuming winter season, but it is probable that they will decrease with the advent of warmer weather. If at any time gasoline prices also are depressed, there may be a reduction in the price of crude oil."

• • •

TRANSITION

Frontier Oil Refining Co. and Frontier Transportation Co. will be merged into Ashland Oil & Refiining Co. Included in the deal are Frontier's Buffalo, N. Y., refinery with a rated capacity of about 12,000 b/d, now running at about 8,000 b/d, marketing and pipeline properties. Frontier's producing properties, however, are not included. Ashland is now processing crude oil at rate of 68,000 b/d with rated capacity of 75,000 b/d for all refineries.

Eagle Oil & Refining Co., Los Angeles, with a 5,000 b/d refinery now shut down, has acquired control of Sunset Oil Co., Los Angeles. Sunset operates an 8,500 b/d skimming plant in Los Angeles.

• • •

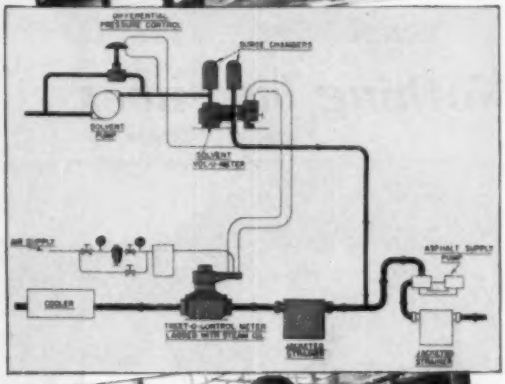
MISCELLANY

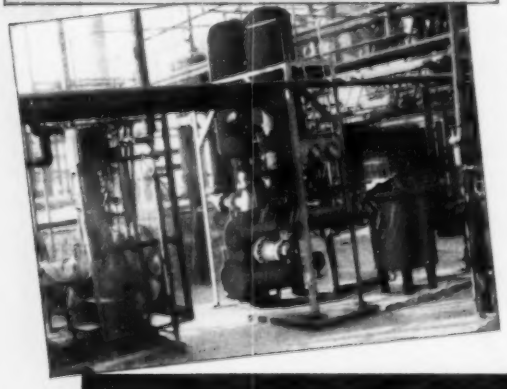
Sinclair Refining Co. will market a new multi-purpose grease—Sinclair "Litholine"—after April 1. It combines lithium base soap and a highly refined mineral oil.

Texas Railroad Commission shortly will call a special hearing to discuss advisability of regulating output of liquid fuels from natural and casinghead gas. Independent Producers and Refiners Assn., requesting the hearing, said 290,000 b/d of natural gasoline is extracted from Texas gas, filling a market otherwise requiring 580,000 b/d more crude oil, and estimated that natural gas has taken away markets for another 591,000 b/d of crude. The request asked the commission to consider prorating gas production statewide, rather than by single fields, and recommended taking into account casinghead gasoline and cycling plant liquids along with the crude in filling Texas market demand. All should be required to keep products underground until market requires them.

A record research program in 1950 will cost Shell Oil Co. about $1.5 million a month. The research fields to receive major attention are the development of new chemicals from petroleum and the development of agricultural products to enable farmers to grow more food at less cost. The $18,500,000 earmarked for research in 1950 will support the various Shell laboratories throughout the world, the major portion of the budget going to the four principal U. S. research centers located at Emeryville, Calif.; Houston; Wood River, Ill.; and Modesto, Calif.

Clean Up Your Asphalt Blending Operation





% PROPORTIONEERS % CONTINUOUS PRODUCTION METHOD CONFINES ALL FLUIDS IN PIPE LINES THROUGHOUT PROCESS

These views of the %Proportioneers% continuous, automatic, cut-back installation at the General Petroleum Corporation Asphalt Refinery in Vernon, California, indicate the cleanliness and compactness of this modern method. Open tank mixing and the fire hazard due to foaming are entirely eliminated. Less tankage is required for storage since blending is performed as a continuous process and batches can be delivered direct to tank cars. Rehandling is avoided, with consequent savings in time, power, equipment and evaporation loss. By means of this highly flexible %Proportioneers% system, one operator can . . . with a single adjustment . . . continuously reproduce any cut-back having a viscosity within specification limits.

Ask for
Standard Methods Brochure No. 110

% PROPORTIONEERS, INC. %

Write to %Proportioneers, Inc.%, 447 Codding St., Providence 1, Rhode Island
Technical service representatives in principal cities of the United States, Canada and Mexico.

TUBES

. . . TUBES

. . . Nothing but tubes

B&W Tube Co. representatives are pass-keys to all tubing problems—pressure or mechanical . . . carbon, alloy, or stainless . . . special shapes . . . tailor-made physical and chemical properties. They sell tubes, tubes, nothing *but* tubes. Their factory training in "tube-technics" embraces everything from material selection to method of shipment. They are experienced in uncovering unexpected tubing economies. There is one near you. Ask him. He *knows!*

B&W SEAMLESS and WELDED TUBES

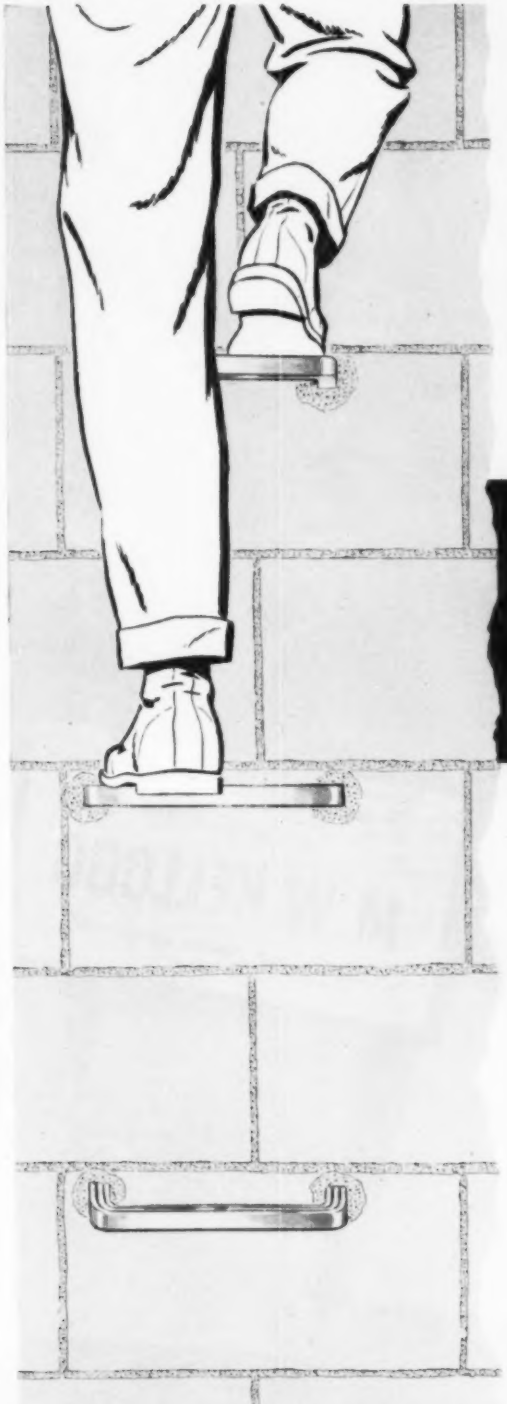
THE BABCOCK & WILCOX TUBE COMPANY

General Offices: Beaver Falls, Pa.

Plants: Alliance, Ohio, and Beaver Falls, Pa.

Sales Offices: Alliance, Ohio • Beaver Falls, Pa. • Boston 16, Mass. • Chicago 3, Ill. • Cleveland 14, Ohio • Denver 2, Colorado Detroit 26, Mich. • Houston 2, Texas • Los Angeles 15, Calif. • New York 16, N. Y. • Philadelphia 2, Pa. • St. Louis 1, Mo. • San Francisco 3, Calif. • Syracuse 2, N. Y. • Toronto, Ontario • Tulsa 3, Okla. • Vancouver, British Columbia

TA-1525



SAFER

...because Aluminum Lasts!

ALCOA FORGED ALUMINUM MANHOLE STEPS AND LADDER RUNGS

ALCOA ALUMINUM ®

Aluminum is non-sparking. That's why you'll want these new Alcoa Aluminum Steps wherever explosive gases are present. For extra safety, they're grooved to give a firm foothold. These sturdy aluminum steps are forged from a high-strength alloy—will take a 1,000-pound load without permanent deformation. Because of aluminum's high resistance to corrosion, they require virtually no maintenance, last years longer.

Available in three sizes for easy installation in any type of masonry, outside or inside. Call your nearby Alcoa Sales Office for information and prices. Or write for free folder. ALUMINUM COMPANY OF AMERICA, 1810D Gulf Bldg., Pittsburgh 19, Pa.

SAFE • NON-SPARKING • STRONG • DURABLE • ECONOMICAL

Kellogg's unique devices aid in producing special types of process piping

NOT only does Kellogg fabricate virtually any type of process piping from carbon steel to alloy and alloy-lined, but it also rolls, welds and forms it from plate in sizes beyond those readily available from tube mills.

When it comes to fabricating and bending, size is limited only by what can be shipped. One-piece bends up to 96-inch diameter are made on an exclusive bender. Larger diameter bends are made from welded segments. Small diameters are handled on regular bending tables and fabricated into sub-assemblies to minimize field labor. Another unique machine produces quality corrugated pipe for expansion bends.

If you are in the market for process piping of any kind, look to Kellogg!

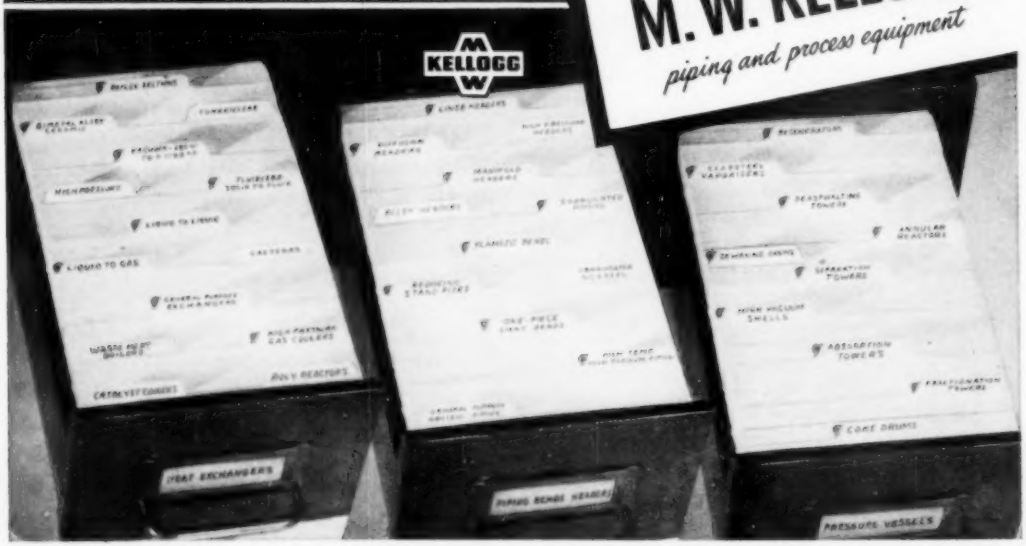
Exclusive!!! One-Piece Giant Bends

If you require smooth interior contour on piping larger than 36 inches, it will pay you to investigate the advantages of Kellogg's *one-piece giant bends.*

To master temperature and pressure use

M. W. KELLOGG

piping and process equipment



The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris

Tomorrow

. . . IN PETROLEUM TECHNOLOGY

By B. H. WEIL, Atlanta, Ga.
Editor, "Monthly Summary of Industrial Developments"

Brief Reviews of Current Technological and Economic Developments, Reported in the Light of Their Possible Effect on Future Petroleum Processing Operations

Jet Engines Receiving Concentrated Attention

EVENTS of the past few months have proved again that jet engines are the "coming thing" in commercial aviation, regardless of possible intervention of turbo-prop power plants. In Great Britain, for example, it is reported[1] that the British Government is planning to use jet-powered engines on new Royal Air Force transport carriers and that "the nationalized British Overseas Airways Corp. is talking of pruning—or junking entirely—an order for 25 piston-powered Bristol '175' long-range transports. The airline would use a jet-powered version of the same model for overseas hops. . . . English engineers at deHavilland claim that trial flights indicate that one of their company's pure-jet 'Comets' can chalk up about 50% more ton-miles annually than a similar piston model, and cut operating costs about 20%."

It seems generally agreed that jet engines are more efficient (and more economical) than other types of power plants at speeds in excess of 500 mph. Moreover, *National Petroleum News* reports[2] that "fuel requirements of individual jet engines will drop sharply during the next few years, according to some engineers in the aircraft industry. Today's jet engines used in commercial aircraft, they say, would consume about 2-2.5 times as many gallons of fuel per ton-mile as the same planes powered with conventional reciprocating engines. Developments now on the drawing boards, however, may cut this figure in half, they claim."

Incidentally, the Wright Aeronautical Corp. is now conducting extensive experiments on ram-jet engines, "which reach their best efficiency only when traveling through the air at 1,200 to 2,600 mph." Wright's test plant "can simulate flight speeds up to 2,600 mph at altitudes as high as 80,000 ft." J. Charshafian, manager of Wright's ram-jet division, has "pictured the ram-jet as an auxiliary power plant for a commercial transport of the future. The ram-jet might be turned on when the plane has already developed a speed of 500 mph using turbo-jet engines. . . . Only the rocket can exceed the speed of the ram-jet. However, Charshafian said, the ram-jet gets six times more power out of its fuel than the rocket, which consumes no air but which carries its own supply of oxygen to support combustion."[3]

The turbo-prop engine also bids fair to see near-future use. The Allison Division of the General Motors Corp. is installing two of its model T-38 turbo-prop engines (each capable of 2,750 hp) in a Consolidated Vultee Aircraft Corp. model 240 "Convair-Liner." This plane, after experimentation, will be used as a cargo plane, perhaps on loan to commercial airlines.

The aviation industry would very much like to get Government assistance in financing the design of jet transports, but it does not appear that Congress will grant the necessary funds. Competition within the industry is such, however, that it is highly likely that individual manufacturers will intensify their own developmental programs.

The day of the piston-powered engine is not at an end in the aviation field, nor does it seem likely that this engine will ever go into complete eclipse, but it *does* appear "handwriting on the wall" that the petroleum industry can expect vastly increased demands for jet fuels within the next decade.

"Alcohol-Gasoline" Still Poses Threat to Petroleum Fuels

WHILE Secretary of Agriculture Charles F. Brannan is said to object to the corn-alcohol fuel proposals of Senator Guy M. Gillette on the grounds that corn would have to average 25c or less per bushel to make them feasible—and that the resulting "alky-gas" would then have to be tax exempt—the "alky-gas" specter has again raised its battered head. Government-held surpluses of corn already total 200,000,000 bushels, and prospects for the next few years indicate that this surplus will grow instead of diminish. Since pressure to reduce or eliminate Government losses from crop-support programs is becoming politically intense, action in many directions may be expected, and one move will probably be a renewed attempt to legislate "alky-gas" into being, either as such or as a compulsory blend with gasoline.

The growing surpluses of farm crops *do* pose very definite problems, of course. Potatoes in particular are much in the public eye (to use a bad metaphor). As the *Oil, Paint & Drug Reporter*[4] has put it, however, "in case some people have been wondering why the potatoes that are piling up on the Government are not turned over to industry for manufacture into alcohol for motor fuel, the answer is a simple one. It can't be done economically, even when the potatoes are given free.

"The way it works out is something like this. The cost of transporting potatoes from Long Island to Philadelphia, for example, runs around 20c/100 lbs. From each 100 lbs. it is possible to get one gallon of alcohol; thus far the alcohol costs 20c/gal. The bags in which the potatoes were packed can be sold for 10c each, reducing the cost of the alcohol to 10c a gal., but the cost of getting the alcohol out of the potatoes runs around 15c/gal., making the total cost of the alcohol 25c/gal. before taxes. . . . Unless the plants are close by, even materials given away free become expensive."

Alcohol injection will probably not enter into the legislative picture except as a talking point, since few cars are presently equipped to use it. It is interesting to note, however, that C. H. Van Hartesveldt, vice-president of the Thompson-Toledo Vitameter Corp., recently replied to a question as to why Vitameters are not yet available throughout the country by stating that his organization had first desired to gain marketing and service operating experience and had felt that it was absolutely necessary to make certain that Vitane could be handled by service station operators without toxic effects. Vitane has now been found harmless when handled in accordance with instructions, and it is felt that sufficient experience has been gained to permit nation-wide distribution of Vitameters and Vitane fluid in the near future.

Politics and economics often make strange bedfellows when it comes to technical matters. The petroleum industry, already faced with at least a small surplus of gasoline production, may find its materials "conserved" to provide a highly uneconomic market for farm surpluses which owe their existence to political exigencies.

Oxo Process Gaining Favor In Petrochemical Field

NO matter what the economics of manufacturing synthetic fuels from coal or natural gas, related processes are certain to find increasing use in this country in the manufacture of organic chemicals. One of these processes, as mentioned in this feature before, is the Oxo method of synthesizing aldehydes and/or alcohols from olefins, carbon monoxide, and hydrogen—a modification of the Synthine process.

According to *Chemical Engineering*,[5] "at least eight companies are excitedly eyeing the Oxo process. . . . The eight: Esso Standard, Indiana Standard, Oronite, The Texas Co., Shell, Rohm & Haas, Du Pont, and Tennessee Eastman. . . . Three have actually started production, two in revamped units and one in a new pilot plant. Another has construction under way on a plant that will employ the process."

Esso Standard is producing isooctyl alcohol at Baton Rouge, La., in a redesigned high-pressure (3,000 psi.) hydrogenation unit. Indiana Standard "played it smart. Early in 1949, blaming high construction cost, it temporarily shelved plans to revamp high-pressure equipment at its Whiting, Indiana, refinery for production of nonyl alcohol by the Oxo process. Thus it could wait to see how the others made out."

In a pilot plant near Philadelphia, Rohm & Haas has been producing nonyl aldehyde from diisobutylene, carbon monoxide, and hydrogen, and then manufacturing derivatives from the nonyl aldehyde. It "may later build a commercial plant, perhaps at the company's Texas site. . . . Du Pont, too, starts with diisobutylene, makes an aldehyde from it, then hydrogenates the aldehyde to the alcohol" in a modified unit at Belle, West Virginia. The product, trimethyl hexanol, is finding its market in the plasticizer field. "Latest entry into this fast-moving Oxo field is Tennessee Eastman," which has "just started construction of a whopping plant on a 2,500-acre site near Longview, Texas, where abundant oil and natural gas are on tap. The first chemical to come from this plant when it gets going in 1951 will be butyric acid. And it will be made by a modified high-pressure Oxo synthesis." Propionic acid may also be produced.

The Synthine process and its variants are among the more interesting syntheses developed in the last quarter of a century, both as regards production of hydrocarbon fuels and chemicals. The Brownsville, Texas plant of Carthage Hydrocol will certainly command headline attention this year as it produces the first commercial gasoline synthesized in this country, and it also seems certain that the chemicals produced as Synthine by-products and by such deliberate syntheses as the Oxo process will meet with equal attention in the chemical field.

Predict Lower Production of Petroleum Cresylic Acids

ACCUSTOMED as the petroleum industry has become to widening markets for its chemical products and by-products, it comes as somewhat of a shock to realize that petroleum fractions do not always present a limitless source of certain materials and that changes in methods of refining—changes made to effect better yields of superior major products, such as gasoline—often wreak havoc with production of by-products from earlier processes. Such, apparently, is the case for the petroleum cresylic acids.

According to a recent survey on cresylic acids[6] "complex factors point to reduced production by both coal-tar and petroleum producers." Future shortages in the cresylic acid market are expected to result from further increases in demand from the plastics and related industries, coupled with "diminishing production of coal-tar acids from the steel industry. . . . The petroleum industry supplies approximately 33% of the domestic cresylic acid production today. How this industry can continue to maintain its production is now being turned over in the minds of petroleum refiners. Near-maximum yields are obtained from the thermal cracking operation using only certain types of petroleum distillates, since not all types of petroleum contain the necessary properties.

"It has been known for some time that the petroleum industry is converting from thermal cracking to catalytic cracking units, with the result that production is being reduced on all petroleum cresylic acids. Since no oil companies today are known to be contemplating building plants in connection with this operation, the production of cresylic acids can only be increased by changes in treating operations or improvements in recovery techniques. Therefore, further increases in production, when desired in the future, can be effected only by these two factors, and authoritative estimates claim a possible increase of 5-10%. This low increase in production would not contribute appreciably to the over-all supply."

Since the amount of cresylic acids in cracked petroleum distillates is in the order of 0.01 to 0.1%, and since there is presently no shortage, it is difficult for a company to reconcile large expenditures in equipment for their recovery.

Interestingly enough, among the methods suggested as possible solutions to the problem of future shortages are synthesis of cresols from toluene and extraction of cresylic acids from fractions produced from petroleum by such methods as the Catarole process.

"The only long term solution seems to lie," according to this same survey, "in the production of synthetic cresylic acids. Today, a number of companies are working at full speed on this problem, and some is made commercially. The manufacture of synthetic cresylic acids presents no problem chemically, but it is rather the process and economics which remain to be worked out. Development work on the manufacture of cresols from toluene either by chlorination or by sulfonation and caustic fusion is in progress at the Polytechnic Institute of Brooklyn and in a number of other chemical laboratories. Special cracking processes such as the Catarole process, aimed at the production of aromatics, are another answer. Synthetic cresol seems to be the only possible and real solution to the long range problem."

Toluene, of course, is a major "chemical from petroleum," and it is not unlikely that operations similar to the Catarole process will be conducted on a commercial scale in this country.

By-product economics are peculiar unto themselves. By-products are often the "tail that wags the dog" when it comes to making a process economic, but, when the amount of a "by-product" on the market fails to satisfy demand, there is seldom an easy way to obtain increased supplies, since demand for the major products involved may actually be going down instead of up. Such is now the case for glycerine—in heavy demand, but in short supply because of weak markets for soap, the major product from the usual method of synthesis—and for benzene, a coal-tar derivative which, like the cresylic acids, is suffering a market shortage because its production is tied to relatively inflexible (and possibly weakening) demands for coke for steel production.

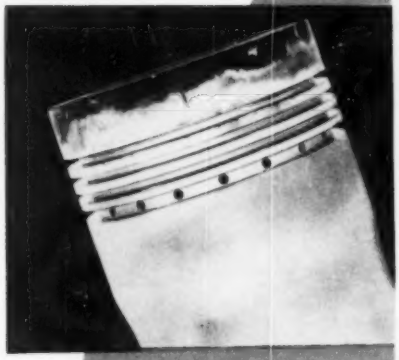
In any event, by-product petroleum cresylic acids bid fair to fail to meet demand in the near future. Whether resort will then be made to synthesis from toluene, etc., cannot clearly be predicted at this moment.

References

(1) *Wall Street Journal*, Feb. 6, 1950, p. 1.
(2) "Ahead of the News—Jet Fuel Requirements," NATIONAL PETROLEUM NEWS, 42, no. 5, 5 (1950).
(3) *Business Week*, Feb. 4, 1950, p. 50; *Wall Street Journal*, Feb. 3, 1950, p. 1.
(4) "Crops for Alcohol," *Oil, Paint & Drug Reporter*, 157, no. 10, 32 (1950).
(5) "Oxo Contagion," *Chemical Engineering*, 57, no. 2, 111 (1950).
(6) R. S. Aries and S. A. Savitt, "Cresylic Acids," *Chemical and Engineering News*, 28, no. 5, 316-21, 362 (1950).

SANTOLUBE HEAVY-DUTY ADDITIVES

give your lubricants top performance at lowest cost



DIESEL ENGINE PISTON

after test run equal to 480 hours of operation, with lubricant improved with Santolube 360.

MONSANTO PETROLEUM ADDITIVES

SANTOPOUR,* SANTOPOUR 8 Pour point depressants.	SANTOLUBE 390-A, 393-A, 830 Motor oil detergents.
SANTOLUBE* 393, 395-X, 398, 394-C Motor oil inhibitors.	INHIBITOR-DETERGENT COMBINATIONS for premium and heavy-duty service.
SANTODEX* Viscosity index improver.	SANTOLENE* C Rust inhibitor.
SANTOPOID* 5, 5-R1, 29, 30 Gear lubricant additives to meet requirements of Army Specifications 2-105A and 2-105B.	SANTOLUBE 53 Cutting oil additive.

*Reg. U. S. Pat. Off.

Tractors and "dozers" . . . buses and tractor-trailers. These pachyderms of motordom need superior lubricants . . . the kind you can make with Santolubes 360, 374 or 379 added to suitable base stocks.

These Santolubes are detergent-dispersant, antioxidant-type additives especially developed for heavy-duty lubricants. They keep engine parts clean by minimizing the formation of sludge and varnish deposits under high speed or cold "stop and go" operation. Corrosion is prevented, giving longer life to bearings and other engine parts. These additives are all satisfactory in compounding oils meeting U. S. Army Specifications and have been tested thoroughly both in the laboratory and in field service.

One of these Santolubes should be particularly suited for your base oil blend. Samples for your experimentation will be sent, without charge, upon request. Or, we will assist in the selection of the Santolube best adapted to your base stocks. For details, mail the coupon. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1746-C South Second St., St. Louis 4, Mo.

MONSANTO CHEMICALS for PLASTICS

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1746-C South Second Street, St. Louis 4, Missouri

Without cost or obligation, please send the following: ..... Sample and data of Santolube 360; ..... 374; ..... 379; ..... Information on free laboratory service.

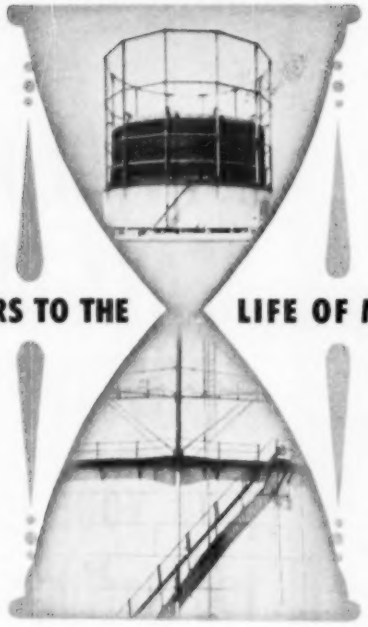
Name ..... Title .....

Company .....

Street .....

City ..... Zone ..... State .....

SERVING INDUSTRY . . . WHICH SERVES MANKIND



HOW TO ADD YEARS TO THE LIFE OF METAL SURFACES

Dum Dum for Metal stops rust and corrosion

Now there's a way . . . an easy, economical and attractive way to protect exposed metal surfaces. Dum Dum for Metal, scientifically developed to protect metal surfaces against the hazards of weather-wear, industrial fumes and gases, stops those deadly enemies of metal structures . . . rust and corrosion.

Why be satisfied with temporary protection?

When metal structures—particularly tanks—are coated with ordinary rust and corrosion inhibiting materials, protection is of temporary duration. Dum Dum for Metal has extended the maintenance cycle to as much as 10 years. That's more than 3 times the life of ordinary coatings.

Free maintenance years!

The cost of Dum Dum for Metal is approximately 2½ times that of a paint job. In most instances where the normal repaint cycle is 3 years, every year beyond 7 gained with Dum Dum for Metal may be considered "a free maintenance year." Write today for an interesting, informative booklet on Dum Dum for Metal. Address Dept. P-3.

® "Dum Dum" is a registered trademark of The Arco Company.

Dum Dum **for METAL'S IMPORTANT ADVANTAGES**

MORE THAN A PAINT—Dum Dum for Metal is spray-applied in a thick, tough but elastic coating 1/16" to 1/8" thick. It adheres firmly to metal surfaces regardless of shape or contour.

NO MOISTURE VAPOR TRANSMISSION—Most paint films breathe, allowing moisture vapor to pass through. The unique properties of Dum Dum for Metal permit no measurable moisture vapor transmission.

STAYS PLIABLE—Dum Dum for Metal's outer surface sets hard while the undersurface remains pliable and elastic.

HEALS ITSELF—Should Dum Dum for Metal's hard outer surface be bruised or broken, the pliable undersurface hardens where exposed, healing itself and preventing the entry of moisture and other contributors to metal deterioration.

ARCO
SINCE 1881

Paints, Lacquers, Varnish, Enamels, Protective Coatings

TRADE MARK

TESTED FIRST TO MAKE IT LAST!

THE ARCO COMPANY • CLEVELAND • LOS ANGELES

in process design

these Lummus men bring you a world of experience

turn page . . .

The Lummus man

responsible for the process design of your project has had more than fifteen years' experience in design, development and operation. He holds a master's degree in Chemical Engineering from a leading university or engineering college. His background includes refinery operation, maintenance and construction along with process design engineering.

Noteworthy projects that have widened his Lummus' experience are: the 2 world's largest synthetic rubber projects; the 13 complete aviation gasoline plants; over 60 solvent refining lube oil plants, and the many thermal cracking, polyforming and coking units.

His background is worldwide. Currently, he is at work in England, Egypt, France, Sweden, Venezuela, and across the United States. He serves on technical committees, lectures on refinery and chemical engineering practice, and writes technical papers. His viewpoint is broad and practical.

The Lummus Process Design Engineer—trained to work with molecules—is equally well equipped to work with people. You will find him keenly aware of the gains that come from co-operative interchange of information with your own technical staff. He contributes in large degree to the satisfactory relations that exist between industry and Lummus.

THE LUMMUS COMPANY
420 Lexington Avenue, New York 17, N. Y.

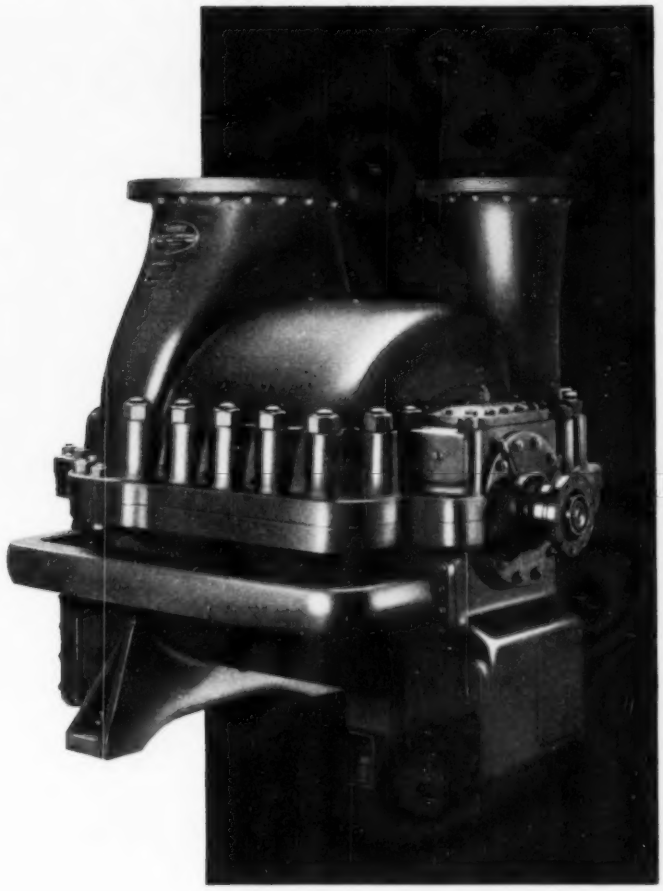
LUMMUS

CHICAGO—600 South Michigan Avenue, Chicago 5, Ill.
HOUSTON—Mellie Esperson Bldg., Houston 2, Texas

The Lummus Company, Ltd., 525 Oxford St., London, W-1, England

Société Française des Techniques Lummus
39 Rue Cambon, Paris 1er, France

Compañía Anónima Venezolana Lummus—Edificio "Las Gradillas"
Esquina Las Gradillas, Caracas, Venezuela



It's an old hand at handling gas

If gas compression is your problem, you can't do any better than a Carrier Centrifugal Gas Compressor. The Centrifugal Compressor was pioneered by Carrier. Today's Carrier Centrifugal is backed by more than 25 years of design, development and operating experience. And it shows!

There is only one major moving part in the Carrier Compressor. The few wearing parts are designed for maximum life and low maintenance costs. All bearings are totally enclosed. Main shaft seals are specifically designed to fit each type of application. Dust, dirt and rain can't get in. You can save the cost of a protective housing. And because there's almost no vibration, elaborate foundations are unnecessary.

The Carrier Centrifugal Gas Compressor is dependable. It does not require constant attendance. Labor for operation and maintenance is kept to a minimum. Some of the first Carrier Centrifugal Compressors built—over 25 years ago—are still in operation. Carrier Corporation, Syracuse, N. Y.

CENTRIFUGAL COMPRESSORS Carrier **REFRIGERATION EQUIPMENT**

[*To obtain more data on advertised products see page* 424]

LEADING REFINERS BLEND

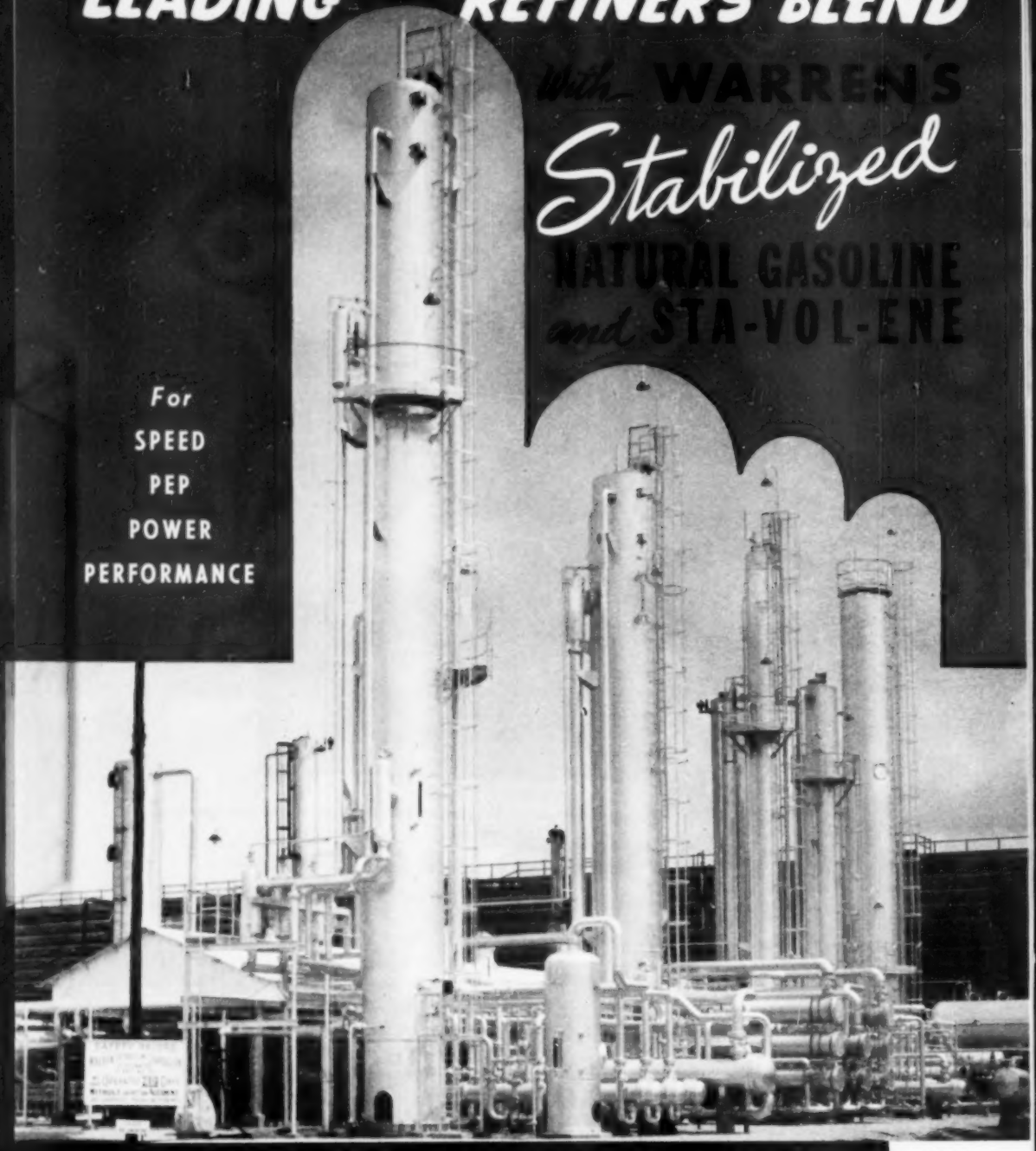
with WARREN'S

Stabilized

NATURAL GASOLINE

and STA-VOL-ENE

For
SPEED
PEP
POWER
PERFORMANCE



WARREN PETROLEUM CORPORATION

Producers, Manufacturers,
Exporters and Marketers

Export Terminals: Corpus Christi, Port Arthur, Baytown, Texas City, and Norsworthy, Houston, Texas.

TULSA 2, OKLAHOMA CABLE ADDRESSES: Stavolene, Warren

WARREN'S GLADEWATER, TEXAS PLANT

Crude Oil, Natural Gasoline and Liquefied Petroleum Products

Headquarters Insignia . . .

. . . for Refiner's No. 2 Operating Material

Today, petroleum refiners use about 1,000 different chemicals in their routine operations, many of them in large volumes. Away up in *number two slot* on this formidable list is *sorptive minerals*—to the tune of some 200,000 tons per year. Adsorbents, as vital processing chemicals, are second only to sulfuric acid.

It is all the more significant, then, that Attapulgus Fullers Earths and Porocel Activated Bauxites have become recognized standards in the field of adsorbents. As of now, at least a billion barrels of petroleum cuts—from the lightest distillates to the heaviest lube and wax fractions—have been treated by Attapulgus or Porocel materials to gain remarkable finished value.

This all adds up to a lot of specialized experience—intimate acquaintance with the process techniques for removing odors, colors, tastes, moisture, acids, sulfur, fluorides and unsaturates from hydrocarbons, as well as for systems employing solid catalysts. And, of equal importance, laboratory and plant experience with the many treatments which precede the application of our two basic materials to specific adsorbent jobs.

Perhaps our broad knowledge can be of real help to you in selecting the right adsorbent and the right conditions. Our staff is at your service, without obligation.

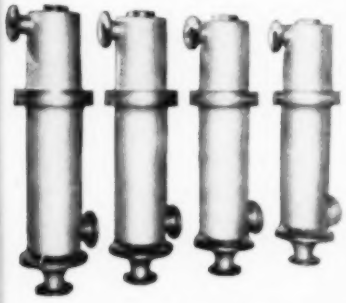
ATTAPULGUS CLAY COMPANY *Fullers Earth* • **POROCEL CORPORATION** *Activated Bauxites*

Dept. D, 210 West Washington Square, Philadelphia 5, Pa.

Pipe Fittings — Ampco pipe fittings are available in all sizes . . . ells, tees, crosses, reducing fittings and flanges . . . forged, wrought, fabricated or cast — with flanged, welding or screwed ends . . . schedule 10 through schedule 160.

Process Pipe . . . Prefabricated Ampco alloys selected for resistance to corrosive action of waste liquors. Prefabricated at Milwaukee from centrifugally cast sections, including flanges. Ampco pipe is also available in extruded seamless IPS up to 4" and in larger diameters welded automatically from Grade 8 plate.

Conveyors . . . Sulphuric Acid Service — Ampco alloys selected for top resistance to erosion, corrosion and abrasion for conveyors handling bulk materials saturated with 10% H_2SO_4 at 210° F. Entire assembly — flights, troughs, shafts, buckets, chain, bearings, etc.—fabricated from Ampco alloys with matching Ampco-Trode electrodes.

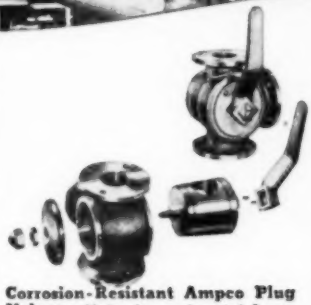


Barometric Condensers and Jet Ejectors — Ampco alloys selected for high strength, corrosion resistance and ability to withstand high-velocity impingement. Sand-cast venturi welded with Ampco-Trode to centrifugally cast body.

Ampco Alloys

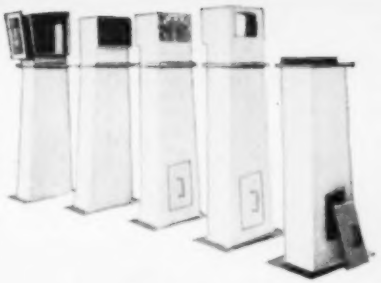
Heat Exchangers — Shown above are typical Ampco fabricated exchanger heads. Complete exchangers including tube sheets, tubing, heads and shells made from corrosion-resistant Ampco alloys are available through the fabricator of your choice.

Ampco Centrifugal Pumps — Here — for the first time in pump manufacturing history — is a "production-built" and "production-priced" pump to handle acids, salts, alkalies, and other corrosive agents hitherto requiring specially built pumps. The Ampco single stage, single suction centrifugal pump offers long life, high efficiency and low maintenance costs through the combination of correct design and properly selected materials.



Corrosion-Resistant Ampco Plug Valves — Made of properly mated Ampco alloys to combine operating efficiency with extremely long life—under the most severe conditions of corrosion, erosion, cavitation, and abrasion. No pockets to trap corrosive liquid. Available from ½ inch up to any desired pressure, in straight-through (2-way) or 3-way, lubricated or non-lubricated types.

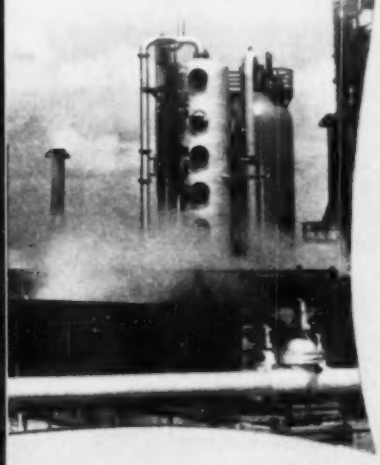
Fractionating Tower...Acetic Acid — Ampco alloys selected for resistance to corrosion by acetic and formic acids . . . and for maximum retention of physicals at temperatures up to 500° F. Fabricated of corrosion-resistant Ampco alloys throughout . . . deep-drawn sheet, plate, extruded tubing, centrifugal castings, etc. . . . welded with Ampco-Trode 160 electrodes.



Chutes . . . Potash Production — Ampco alloys selected to resist the severe erosive and corrosive effects of the mixture being carried. Fabricated of ¼" thick corrosion-resistant Ampco 8 plate welded with Ampco-Trode 160 electrodes. No pre-heating or post-heating was required. The weld joints match the parent-metal in chemical and physical properties.

AMPCO®

Resist Corrosion, Reduce Costs



...with this unique combination of money-saving properties:

1. High resistance to corrosion
2. High tensile strength
3. High physicals at extreme temperatures
4. High weight to strength ratio
5. High impact and fatigue values
6. High wear-resistance — to erosion — corrosion, cavitation, etc.
7. High compressive strength
8. High modulus of elasticity

The long service life of Ampco Bronze Alloys — at a moderate initial cost — offers unusual savings to both designers and plant engineers.

Reduced material failures mean (a) minimum down-time (b) less production loss and (c) lower maintenance costs.

Increase efficiency of design and operation . . . specify Ampco Bronze alloys for handling corrosive and erosive media. Write today for recommendation and complete information.

Ampco aluminum bronzes are available in a number of grades to meet your exact requirements in any form you need: rolled sheet or plate, sand or centrifugal castings, forgings or extrusions . . . pipe and fittings. Also, Ampco's arc-welding electrodes, corrosion-resistant centrifugal pumps and plug valves.

Free . . .
Process Industries Bulletin — 16 pages of money-saving information.

Tear out this coupon and mail today!

Ampco Metal, Inc., Dept. PP-1, Milwaukee 4, Wis.

Send me your free bulletin, giving full information on the application of Ampco Alloys in the Process Industries.

Name .....

Company .....

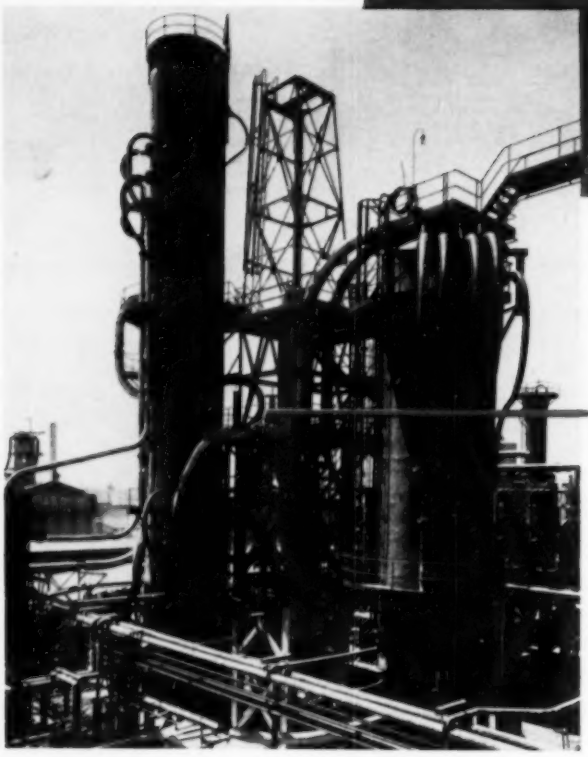
Company Address .....

City ..... ( ) State .....

AMPCO®

Ampco Metal, Inc.
Milwaukee Wisconsin
West Coast Plant • Burbank, California

TRET·O·LITE DESALTING



makes refinery operations *more efficient* *more economical*

By reducing the salt content of charging crudes to a minimum, the Tretolite desalting process helps to eliminate the costly troubles caused by salt. If severe corrosion, plugging and hard coke formation are decreasing your on-stream time and increasing your maintenance costs, why not get in touch with Tretolite? Preliminary tests and a salt survey do not obligate you.

Tretolite Desalting offers these facilities—

Preliminary desalting survey
Laboratory pilot tests
Competent plant design
Construction consultation
Start-up assistance
On-call service

Tretolite Desalting protects against—

Salt plugging
Corrosion from evolved HCl
Hard coke formation
On-stream time losses
High maintenance costs
Impaired equipment efficiency

The Tretolite Company also offers these specialized services to refiners:

Water clarification chemicals · Demulsifiers for waste oil emulsions · Corrosion preventive chemicals · Corrosion resistant coatings · Demulsifiers and foam preventers for use in doctor treating and other sweetening solutions

TRETOLITE COMPANY ST. LOUIS 19, MO.

CHEMICALS FOR THE PETROLEUM INDUSTRY

Dehydrating · Desalting · Water De-Oiling · Corrosion Inhibition
Scale Prevention · Paraffin Removal

T2S8-1

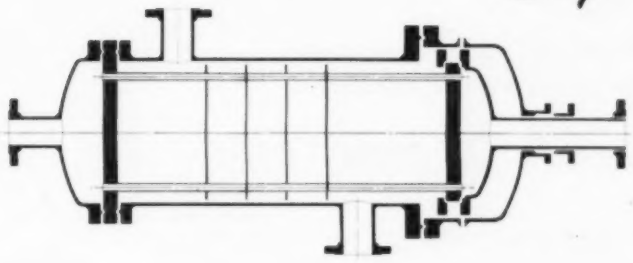
[*To obtain more data on advertised products see page* 424]

For ECONOMICAL, EFFICIENT COOLING

PRODUCT + WATER

WATER — PRODUCT

Specify



SINGLE PASS FLOATING HEAD
REMOVABLE BUNDLE EXCHANGERS

WESTERN SUPPLY COMPANY

Western Heat Transfer Equipment plays an important role in general chemical processing. Close attention to detail and specification, from design to installation, is the prime consideration in the manufacture of all Western equipment. Refineries, chemical processing plants and pipe lines throughout the world depend on Western's economical, uninterrupted service.

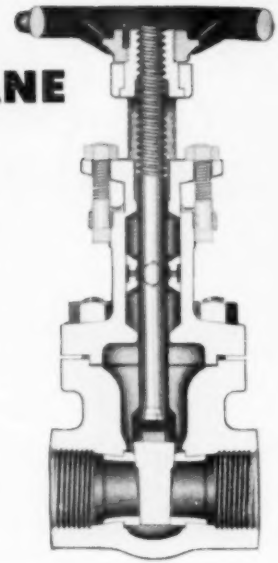
TEMA

WESTERN
HEAT EXCHANGERS

Manufactured by
WESTERN SUPPLY COMPANY
P.O. BOX 1888 TULSA, OKLAHOMA
SALES OFFICES — DALLAS — HOUSTON

SAN FRANCISCO REPRESENTATIVE: TRIDENT ENGINEERING COMPANY

Everything for your piping job ...from one complete line–CRANE



No. 3609A, 600-Pound Steel Gate, Monel trimmed. Sizes: up to 2-inch.

YOUR FIRST CHOICE FOR HYDROFLUORIC ACID

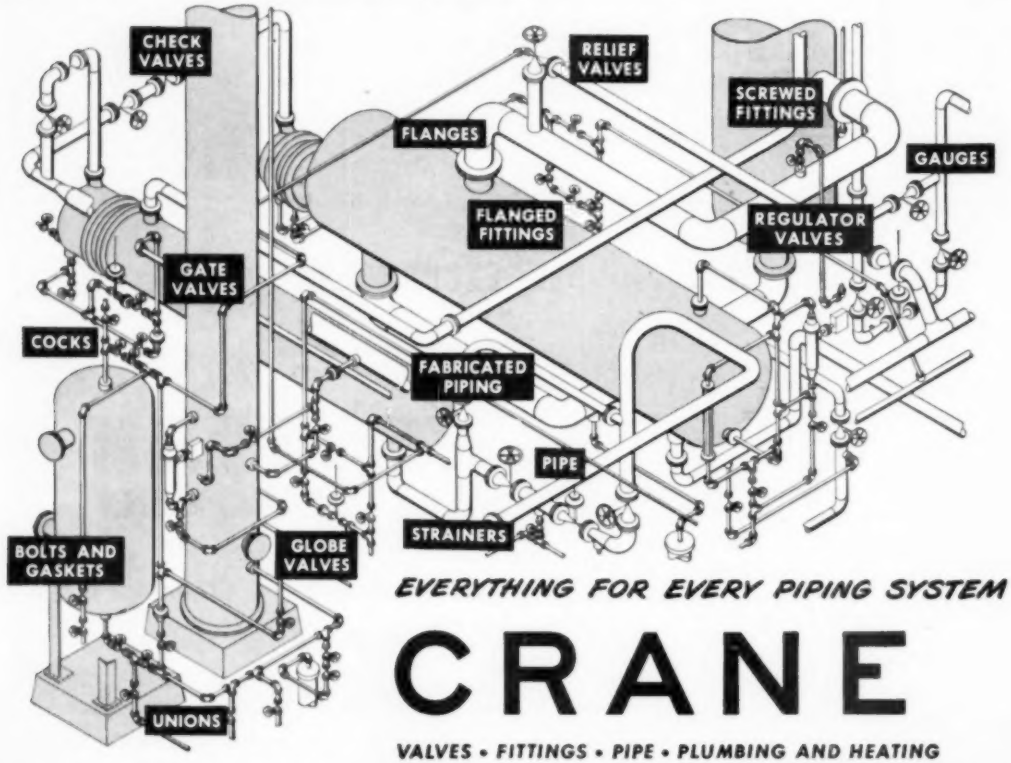
Once you've tried these valves on hydrofluoric service, you'll take nothing less. Made in sizes from ¼ to 2 in., Crane Monel-trimmed 600-Pound Steel Gates and Globes combine the newest features for safe and efficient control of hydrofluoric lines.

For example, note the specially designed extra deep stuffing box equipped with packing spacer, and with a plug opening for proper lubrication of upper and lower packing. Note the heavy body section and husky bonnet joint flanges. A soft iron gasket assures positive tightness; male-and-female faces prevent gasket blowout.

All sizes in this Crane line have outstanding service features. Threads in screwed ends are extra long. Flanged ends have large raised male face with concentric groove finish for leak-proof end connections. See page 377 of your Crane No. 49 Catalog.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE ORDER TO CRANE SUPPLIES ALL PIPING EQUIPMENT FOR THIS HYDROFLUORIC ALKYLATION UNIT, FOR EXAMPLE



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

EXTRAS···

···AT NO EXTRA COST

when you specify

SOLVAY

Supplying chemicals to American industry means more than meeting specifications at a price.

With Solvay . . . it means prompt, *dependable* delivery from coast-to-coast warehouse stocks . . . a continuing supply from five big plants situated in America's industrial centers.

. . . **It means** an all-inclusive *working* knowledge of alkalies, the result of sixty-nine years of experience. And Solvay's "Industry-Wise" Technical Service offers a specialized service that is exclusive with Solvay—a corps of experts who know *your* particular industry.

These "extras"—"extras" that cannot be shown in a specification, or found on a price list—are yours at no extra cost when you deal with America's leading manufacturer of alkalies. Next time you order alkalies and associated chemicals . . . specify Solvay.

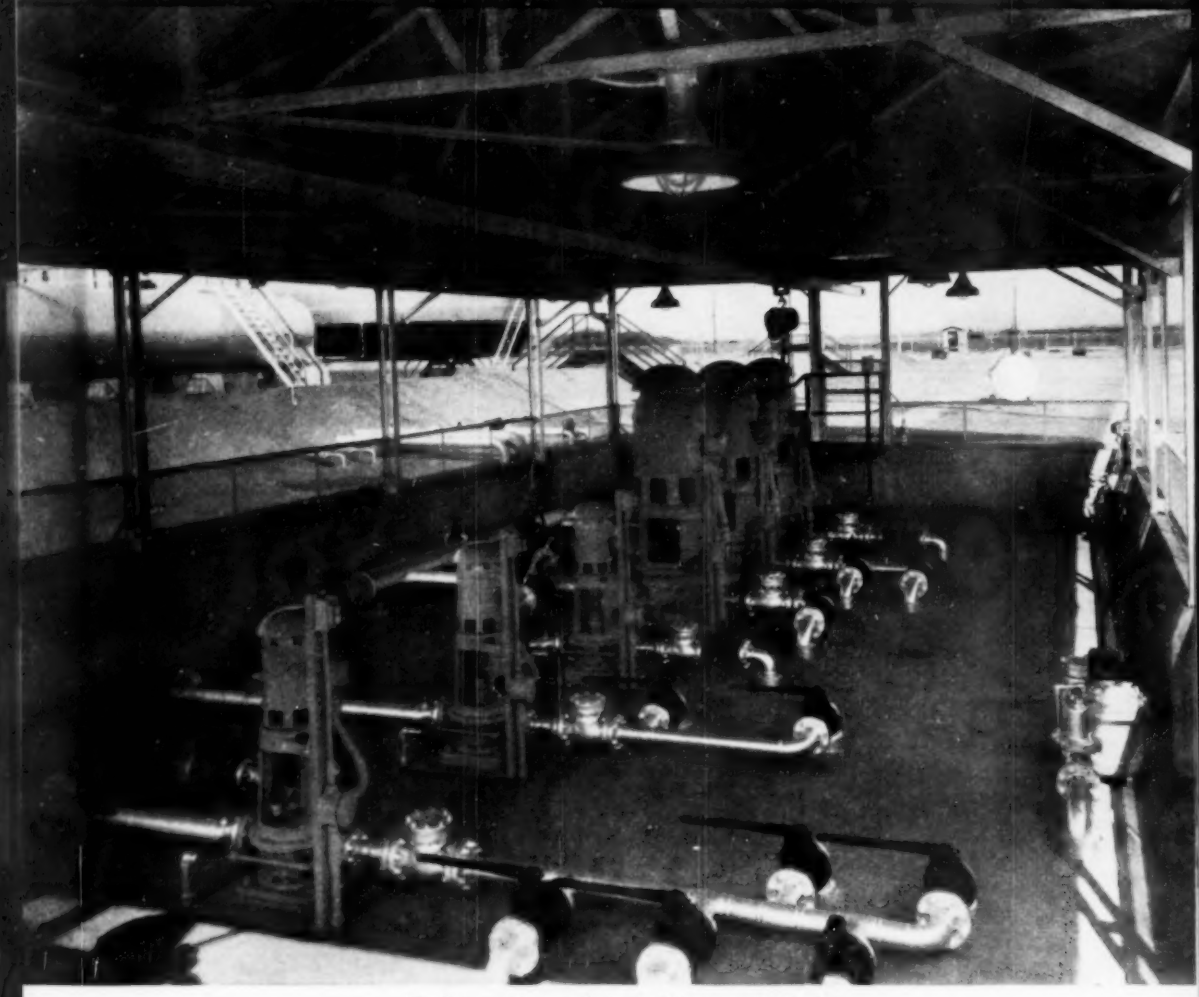
SOLVAY SALES DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • Syracuse

SOLVAY PRODUCTS

Soda Ash • Caustic Soda • Caustic Potash • Chlorine • Potassium Carbonate • Nytron • Calcium Chloride
Sodium Bicarbonate • Specialty Cleansers • Ammonium Bicarbonate • Sodium Nitrite • Para-dichlorobenzene
Ortho-dichlorobenzene • Monochlorobenzene • Methanol • Ammonium Chloride • Formaldehyde

PRODUCTS HANDLING . .



Nordstroms in a products pipe line pumping station.

Nordstrom Valves

NOW AUTOMATICALLY LUBRICATED WITH Hypermatic

TRADE MARK

PATENTS APPLIED FOR

Hypermatic lubricant makes tremendous improvement in Nordstrom valves. Being *energizable* it self-seals, self-feeds, keeping the valves in a 100% lubricated condition, for prevention of leakage and insuring most positive operation. Maintenance costs are cut to the minimum.

. . *infinitely safer* with NORDSTROMS

● In handling petroleum products you first consider *safety*. That calls for ever-tight valves, free from freezing, free to turn easily, positively sealed around the ports regardless of line pressure. Note how perfectly the Nordstrom design fits these specifications. The tapered plug is pressure lubricated, held tight on its unexposed seat by resilient means; the lubricated seat permits easy rotary turning of the plug, as contrasted to metal-to-metal unlubricated seats in common types; "Sealdport" lubrication surrounds each port to prevent leakage; the plug can be hydraulically jacked when required.

For handling gasoline, distillates, butane, propane and other petroleum products, Nordstroms have no equal. They keep upkeep down.

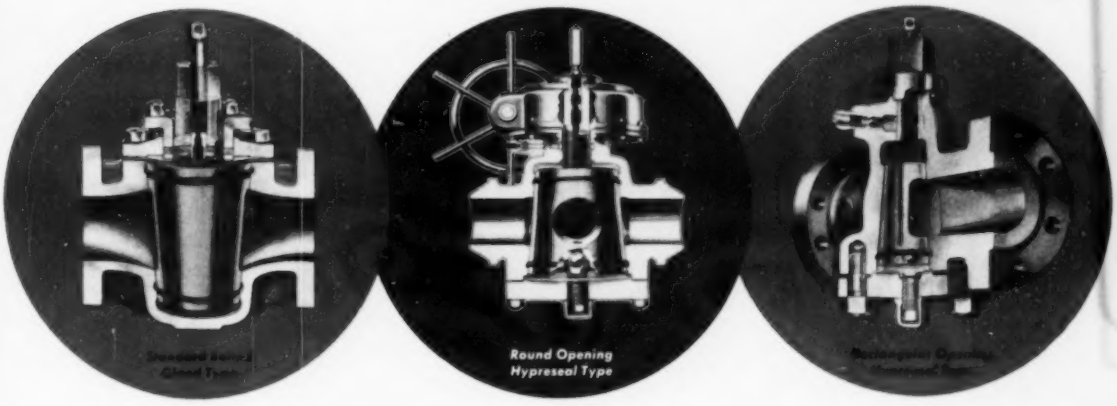
Put Nordstroms to ANY test

Install them, for test, side by side with any other type, check their operation, compare their performance . . . make a record of maintenance costs. You will find them to be tops in performance—and by far the most economical valves you have ever used. Successful operation of over 5,000,000 Nordstroms is proof of performance.

Nordstrom Valve Division—ROCKWELL MANUFACTURING COMPANY

400 North Lexington Avenue • Pittsburgh 8, Pennsylvania

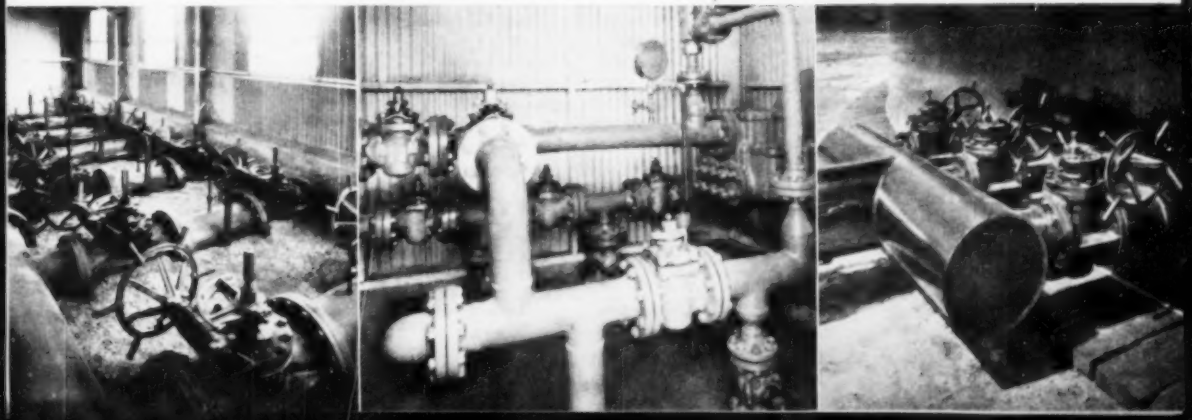
Atlanta, Boston, Chicago, Columbus, Houston, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle, Tulsa
. . . and leading Supply Houses • Export: Rockwell Manufacturing Co., International Division, 7701 Empire State Building, New York 1, N. Y.



Nordstrom valves in a products pump station.

Nordstroms on products line in pump house.

Nordstroms on connections to gasoline storage tank.



Reduce Hazard from Exposure Fires

with a Horton DOUBLE-DECK Floating Roof

(Acme Photo)

Above: 59,500 bbl. crude oil tank burns at a refinery which was destroyed by this fire. The blaze started when naphtha fumes were ignited by a Bunsen Burner in a laboratory nearby and spread to the cooling tower in the foreground. The tower collapsed just after this picture was taken.

Left: 67,000 bbl. tank equipped with a Horton Double-Deck Floating Roof at a California refinery.

The Horton Double-Deck Floating Roof protects the contents of a tank from exposure fires. A recent survey by the American Petroleum Institute shows that most oil fires start *outside* oil property. The danger that such fires will ignite tanks equipped with Horton Floating Roofs is greatly reduced for two reasons:

1. This roof floats directly on the surface of the liquid in the tank and does away with the large vapor space found in cone roof tanks. It blankets the surface of the liquid, eliminating the air necessary to support combustion.

2. The type of seal that is used to close the space between the deck and the tank shell reduces the possibility of a tank with a floating roof catching fire. The efficiency of this Horton Seal in preventing the escape of vapor assures that an inflammable mixture of vapor and air will not persist above the roof. As proof of this, the Underwriter's Laboratories report says "The rate of evaporation and escape of vapors are such that concentration of vapors within the open top above the (Horton) roof may be considered as a negligible factor in the safe use of the roof".

The Horton Double-Deck Floating Roof can be furnished with new tanks or installed on existing tanks whose shells are in good condition. It is particularly recommended for use on tanks filled and emptied frequently, tanks in blending service, tanks storing corrosive products, and tanks located in congested areas.

For complete details about the Horton Double-Deck Floating Roof, write the nearest office for Bulletin B.

CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta 3	2103 Healey Building	Detroit 26	1532 Lafayette Building	Philadelphia 3	1630–1700 Walnut St. Building
Birmingham 1	1527 North Fiftieth Street	Houston 2	2130 National Standard Building	Salt Lake City 4	530 West 17th South Street
Boston 10	1029-201 Devonshire Street	Havana	402 Abreu Building	San Francisco 11	1208–22 Battery St. Building
Chicago 4	2114 McCormick Building	Los Angeles 17	1526 General Petroleum Building	Seattle 1	1330 Henry Building
Cleveland 13	2215 Guildhall Building	New York 6	3310-163 Broadway Building	Tulsa 3	1620 Hunt Building

REPRESENTATIVES AND LICENSEES

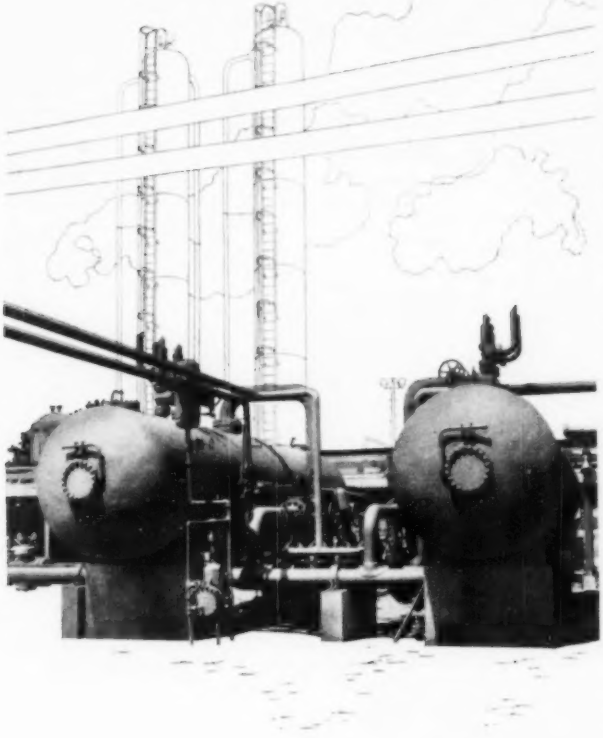
Horton Steel Works, Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Comprimo N. V., Amsterdam-O, Netherlands

The California Company's

Horizontal Dehydration Unit

Dries Natural Gas with

ALCOA *Activated** *Alumina*



This unique dehydration unit at the California Company's Hico-Knowles Plant near Dubach, La., was designed to reduce back pressure by shortening the flow through the desiccant. Forty to fifty million cubic feet of natural gas are dried daily to *minus* 18° F. dew point. Entering the vessels at 100° F. and 900 psig, gas flows vertically through 3' x 30' horizontal desiccant beds containing 30,000 lbs. of ALCOA *Activated* Alumina. Regeneration is accomplished on a 12-hour cycle by natural gas heated to 325° F.

Throughout the petroleum industry, you'll find ALCOA *Activated* Alumina doing steady, reliable dehydrating jobs similar to this one, for a variety of good reasons.

ALCOA Activated Alumina:

- dries liquids and gases to a lower dew point than any other commercial adsorbent.
- is a uniformly pure desiccant that retains its form and properties even after an almost unlimited number of regeneration cycles.
- has high resistance to shock, abrasion and erosion . . . is non-toxic and inert to most gases and vapors.
- packs uniformly . . . will not swell, soften or disintegrate.

Whatever your drying problem, it will pay you to write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 616D Gulf Building, Pittsburgh 19, Pa.

**Reg. T. M., Aluminum Company of America.*

Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

"SNOW STORM" THAT STOPS FIRE!

AER-O-FOAM SNUFFS OUT FIRE
PROTECTS TANKS, BUILDINGS, EQUIPMENT

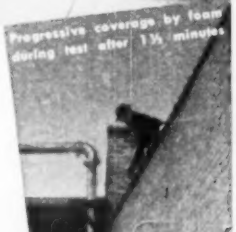
At the first wave of excess heat down comes a blanket of fire-snuffing AER-O-FOAM over the entire loading area. That's the way the new automatic fire foam system protects Schenectady Varnish Company.

Storage tanks with oils, thinners and other flammable liquids, tank cars and equipment are all automatically covered with a three inch blanket of AER-O-FOAM in one minute. A total depth of 21 inches is possible.

National AER-O-FOAM offers fire-tested protection in all types of industries handling or storing flammable liquids. AER-O-FOAM provides a long-lasting, air-tight blanket of foam which quickly and effectively snuffs out fires and keeps them out . . . prevents flash-backs . . . insulates buildings against heat. It is non-toxic, non-corrosive and easily swept away when dry.

If you have a flammable liquid risk, we have the AER-O-FOAM system to protect it. Fires can't be scheduled . . . let us protect your plant now!

Heat test is applied to heat actuated device at beginning of full scale test



Progressive coverage by foam during test after 1½ minutes

NATIONAL FOAM SYSTEM, INC.

Headquarters for Foam Fire Protection

WEST CHESTER, PENNSYLVANIA

DO YOU KNOW THESE

facts about treating?

FACT 1 Mercaptan *removal* is today's answer to deodorization problems.

FACT 2 Modernizing with the *Tannin Solutizer Process* for mercaptan removal yields "new refinery" economies in treating and blending your finished leaded gasoline.

FACT 3 *Conversion and operating costs* are extremely low.

FACT 4 The Tannin Solutizer Process is not *corrosive*.

FACT 5 The high efficiency of the Tannin Solutizer Process has been conclusively demonstrated during more than *five years* of commercial refinery operation.

FACT 6 The Tannin Solutizer Process does not affect the *stability* of the gasoline treated.

FACT 7 Complete Tannin Solutizer *process engineering* service is available—during the planning of your unit, at start-up, and thereafter if required.

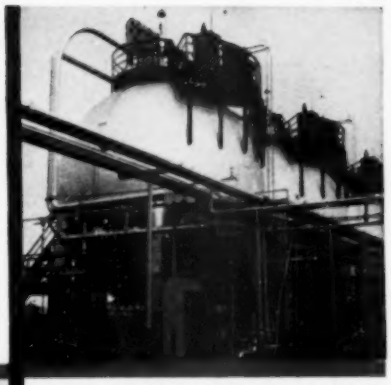
We will welcome the opportunity to work with you on your specific problem. The Tannin Solutizer Process is licensed under the patent rights of Socony-Vacuum Oil Company and Shell Development Company.

SHELL DEVELOPMENT COMPANY
50 West 50th Street, New York 20, New York

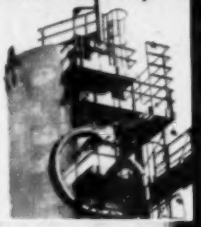
SHELL

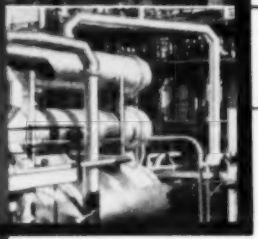
PETRECO DESALTING

consistently delivers a crude charge with minimum salt and solid content. A recent survey of all Petreco Desalters operating in oil refineries throughout the United States and Canada disclosed that Petreco Desalting was showing a very rapid pay-out in terms of improved refinery operations. It showed that:



THESE OPERATING ADVANTAGES	resulted directly in	THESE PROFITABLE ECONOMIES
Higher cracking temperatures.		*Deeper cracking, increased gasoline yield.*
Less plugging in furnace tubes.		*Fewer tube failures, higher charge rates.*
Reduced corrosion in overhead equipment.		*Less shut-downs due to mechanical failures.*
Less plugging in exchangers.		*Lower clean-out costs, more efficient heat exchange, longer runs.*





MUST PROVIDE OTHER COMPLETE DESALTING SERVICE, PERSONNEL AND FACILITIES

These are not the *only* benefits to be derived from Petreco Desalting – they are the benefits consistently enjoyed by the majority of Petreco users. For complete information on Petreco Desalting get in touch with the nearest Petreco office.

PETROLEUM RECTIFYING COMPANY

5121 South Wayside Drive, Houston 1, Texas
648 Edison Building, Toledo 4, Ohio
530 West Sixth Street, Los Angeles 14, Calif.

PETRECO

SPECIALIZED *Electric* PETROLEUM PROCESSES { DESALTING DEHYDRATING

PR 50-4

CASE HISTORY

How Du Pont Service Solved a Tetraethyl Lead Storage and Handling Problem

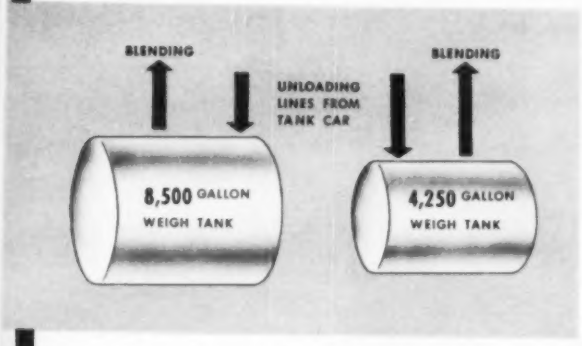
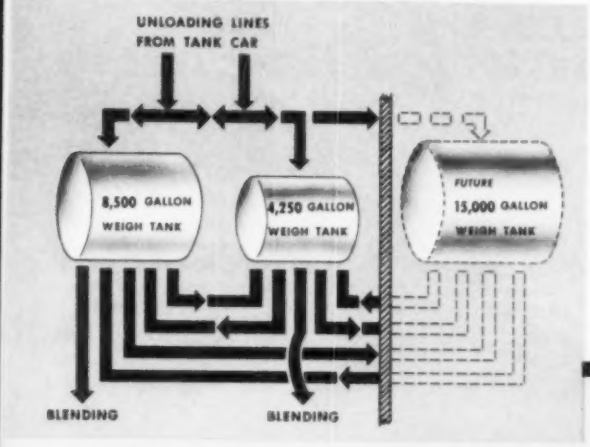


Diagram showing original set-up of TEL weigh tanks in large refinery. Operation of blending plant was inflexible because each tank could only be used individually.



Blending plant diagram after redesign by Du Pont TEL operating division. Complete flexibility was obtained as well as provision for future expansion when desired.

A large refinery was using two tetraethyl lead weigh tanks which had been installed at different times as the plant increased in size. Because each tank had been set up as a separate unit when put in, blending operations were not as flexible as desired.

As demands on the blending equipment increased the refiner sought some method of improving the flexibility of his present TEL blending plant and at the same time provide for the addition of expanded storage and weigh tank facilities.

The Du Pont field representative was called in for his recommendation. After careful analysis of the problem, he made a proposal which:

1. Gave maximum flexibility and economy through modernization of present installation. Provision was made to use existing fittings and other parts wherever possible to keep cost at a minimum.

2. Also provided for future installation of additional weigh tank to handle long range growth. Design enabled new facilities to be hooked into present ones when built, but did not require that money be spent for new storage until needed.

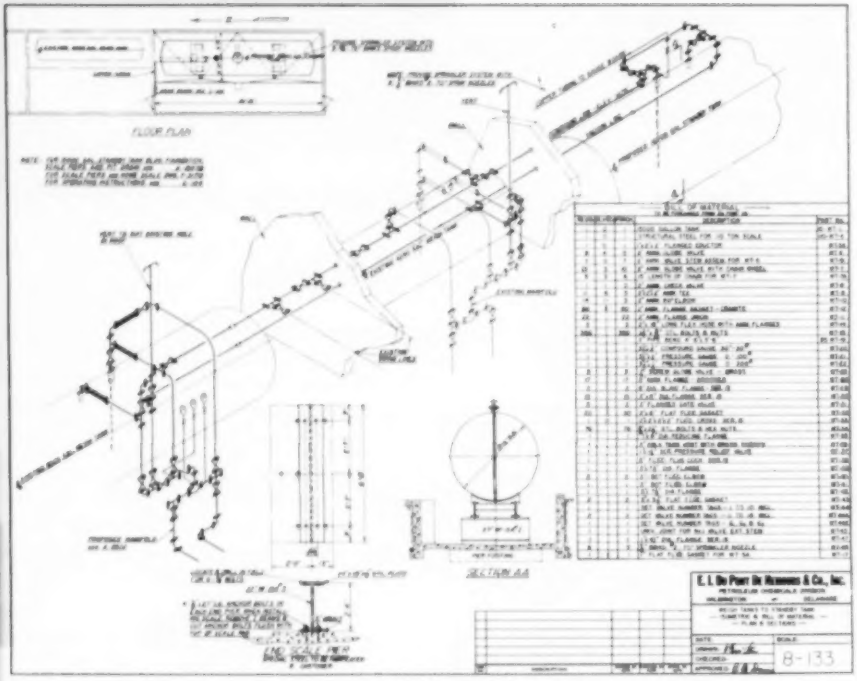
DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING... *Through Chemistry*

USE DU PONT TETRAETHYL LEAD COMPOUNDS

Du Pont Offers These Helpful Services

RESEARCH
TECHNICAL
MARKETING
SAFETY
MEDICAL
FIELD LABORATORY



Du Pont provides complete design service for all TEL handling problems. Valves, fittings and other special parts for blending plant construction, repair and modernization may also be obtained from Du Pont.

Du Pont Services Provide Safe, Practical, Economical Solutions to Your Problems

DID YOU KNOW

Du Pont developed "Nitramon" S, a blasting agent for seismic exploration? These special blasting agents which go under the trade names "Nitramon" S and "Nitramon" WW cannot be detonated even with a rifle bullet. They require a special primer. Blasting agents and explosives are only a few of the many Du Pont products used throughout the oil industry from oil location to finished product.

This case history, where the Du Pont field representative was able materially to improve the flexibility of an existing installation, and provide for future expansion is but another example of Du Pont TEL services in action.

Whenever you have a problem involving TEL handling, blending or storage, call your Du Pont Petroleum Chemicals Representative. His recommendation, based on experience in handling a wide variety of such problems, will offer a safe, practical and economical solution.

This is only one of the many services Du Pont provides in connection with its tetraethyl lead compounds. Others are: Safety, Technical, Research, Medical, Marketing and Field Laboratory.

MAKE DUPONT THE SOURCE FOR ALL OF YOUR GASOLINE ADDITIVES...

- TETRAETHYL LEAD COMPOUNDS (Motor Mix — Aviation Mix)
- ANTIOXIDANTS
- METAL DEACTIVATOR—DYES

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING...*Through Chemistry*

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
PETROLEUM CHEMICALS DIVISION
Wilmington 98, Delaware

District Laboratories: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

District Offices: Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

A-429

Built by GRAVER

Regenerator-reactor unit and stripper . . . main catalyst storage hopper . . . auxiliary catalyst storage hopper for new cat cracker of Wood River Oil & Refining Co., Inc., Hartford, Ill.

Congratulations

WOOD RIVER on the new fluid catalytic cracking unit now on stream, making high octane cat-cracked gasoline. Graver is proud of its part in the completion of this 7500-barrel-per-day unit, designed and licensed by Universal Oil Products Company.

Graver fabricated and erected the reactor and regenerator column and two large catalyst storage hoppers. The reactor is 13'6" inside diameter and the regenerator is 19'8" inside diameter at the bottom. The entire unit stands about 150 feet high.

This work for WOOD RIVER again identifies Graver with new refining plants and prompts investigation by refiners who are planning new catalytic cracking units.

GRAVER

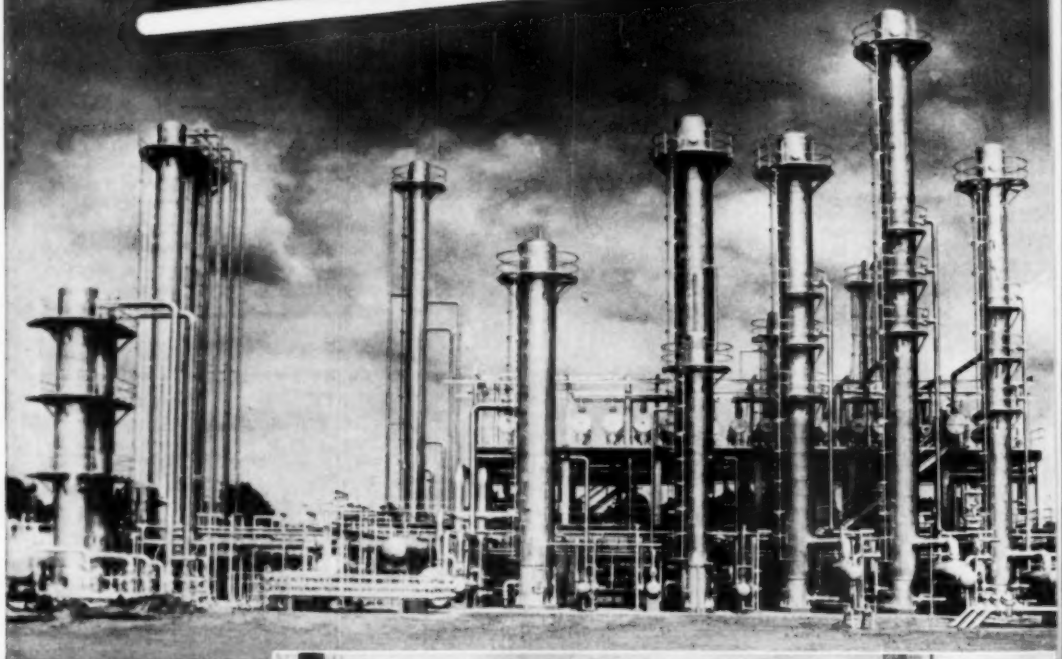
FABRICATED PLATE DIVISION

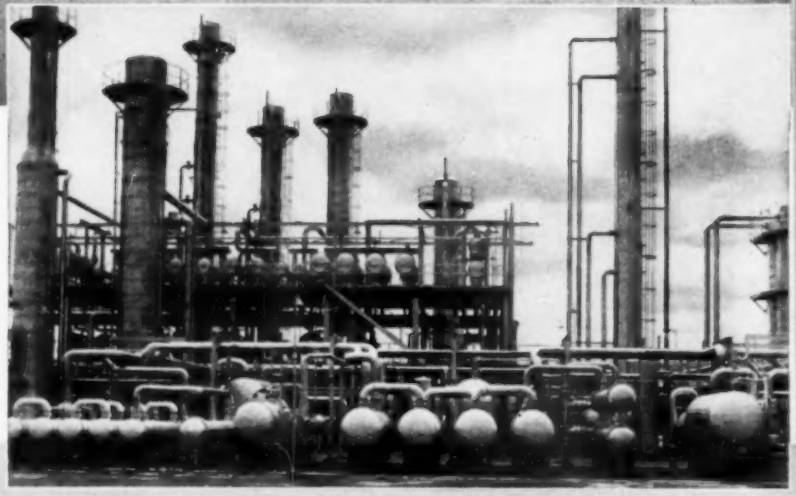
GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

NEW YORK • PHILADELPHIA • CHICAGO • CATASAUQUA, PA. • HOUSTON • SAND SPRINGS, OKLA.

More than 100





GRISCOM-RUSSELL
PIONEERS IN
HEAT TRANSFER
APPARATUS

GR-234

G-R Heat Exchangers

in this installation

...how many can you find?

The engineers of this natural gas plant indicated their conviction of the superiority of G-R Heat Transfer Apparatus in the most definite manner . . . by ordering 110 G-R units for their heat transfer services.

THE ROSTER OF G-R EQUIPMENT IN THE PLANT IS AS FOLLOWS:

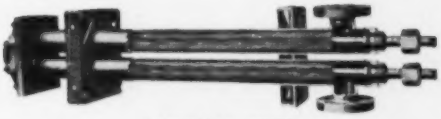
- 40 Shell-and-Tube units for coolers, condensers and oil-to-oil exchangers
- 2 Steam-heated Reboilers
- 61 Twin G-Fin Sections for gas coolers and product coolers
- 5 Oil Chillers using propane as the chilling medium
- 1 Fin-Fan Steam Condenser
- 1 Type R Evaporator

Here, as in many other plants throughout the oil and gas industry, G-R Heat Transfer Apparatus has been selected because of the long G-R leadership in developing designs to meet the advancing needs of the industry, and the proven excellence of performance of G-R equipment.

Whatever may be *your* heat transfer requirements, be sure to consult G-R . . . pioneers in heat transfer apparatus . . . for authoritative recommendations.

THE GRISCOM-RUSSELL CO.

285 MADISON AVE., NEW YORK 17, N. Y.



G-R TWIN G-FIN SECTION

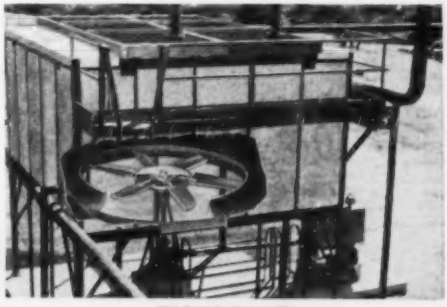
The "universal" standard interchangeable heat transfer unit with longitudinally-finned elements. More than 40,000 installed sections.

G-R TUBULAR EXCHANGER

A shell-and-tube unit with many distinctive features for efficient performance with minimum attendance and maintenance expense.

G-R REBOILER

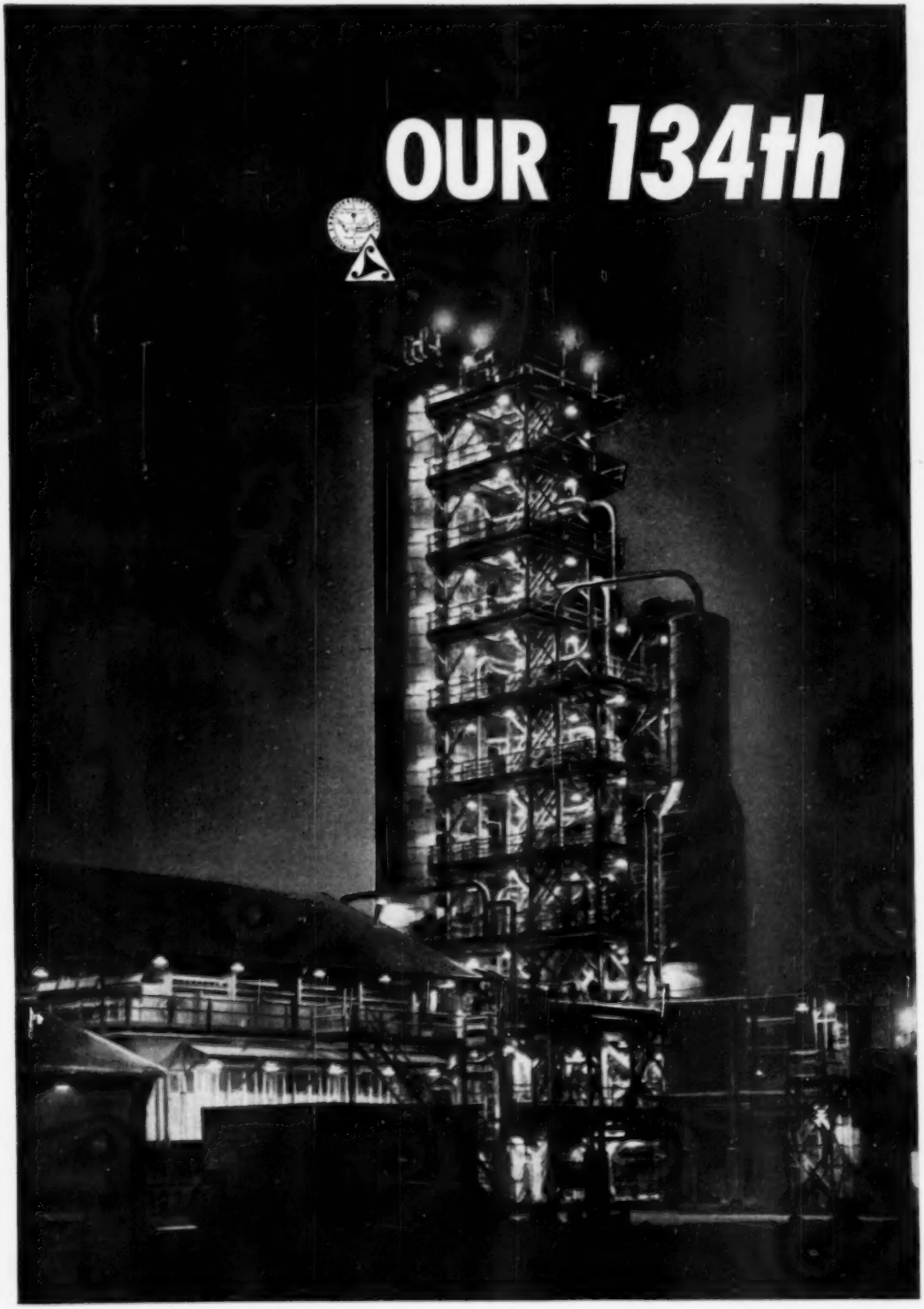
Widely used in process industries, and available with either bare tubes or K-Fin helically finned elements.



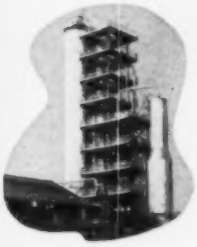
FIN-FAN EXCHANGER

The "package-type" air-cooled exchanger developed jointly by The Griscom-Russell Co. and Fluor Corp. Ltd., and widely adaptable wherever the cooling water supply is insufficient or impure.

GRISCOM-RUSSELL


OUR 134th

CONTRACT ABROAD



This example of Badger's current work in the Sterling area is the largest post-war refining unit in Europe yet to be completed and brought into successful operation.

Badger's British and American companies together designed, procured and installed this 40,000 BPSD crude distillation unit at the Llandarcy Refinery of National Oil Refineries Ltd., for Anglo-Iranian Oil Company Ltd. Practically all of the materials were of British manufacture.

Here is an example of Badger at work in the international scene. Our British Company is well established and its activities integrated with those of the American parent. Relative dollar and sterling effort and equipment can be proportioned to suit respective currency availability, and this arrangement can be extended to provide for other currencies as well.

The establishment of our British Company twelve years ago, which in itself has executed contracts totaling many tens of millions of dollars, is a further example of Badger service to clients throughout the world.

E. B. BADGER & SONS CO. • Est. 1841

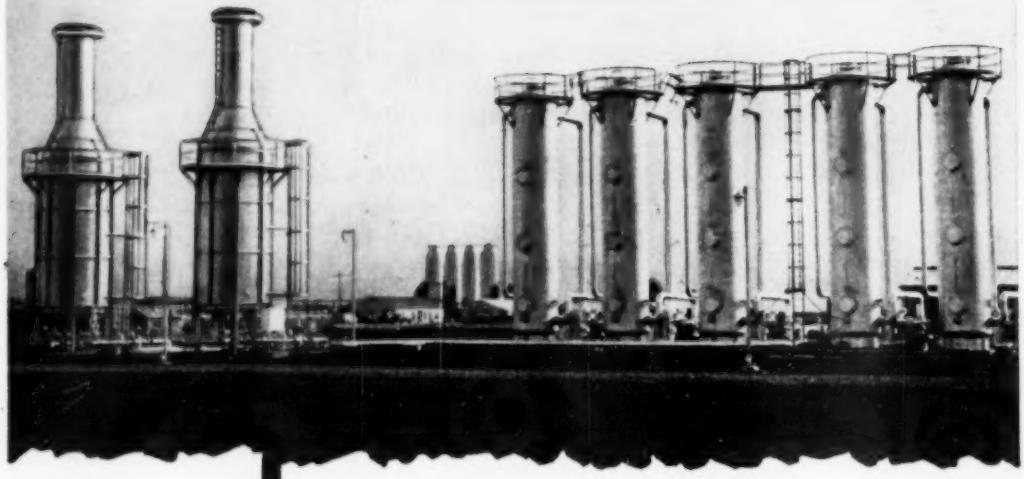
E. B. BADGER & SONS (G.B.) LTD.

SUBSIDIARIES OF STONE & WEBSTER, INC.

BOSTON 14 • NEW YORK • LONDON

Process Engineers and Constructors for the Petroleum, Chemical and Petro-Chemical Industries

PETRO-CHEM ISO-FLOW PIPELINE HEATERS



For

- **GAS DEHYDRATION**
  (direct or indirect heating)
- **GAS SUPERHEATING FOR TURBINE DRIVES**
- **VISCOSITY REDUCTION FOR LIQUID FLOW**

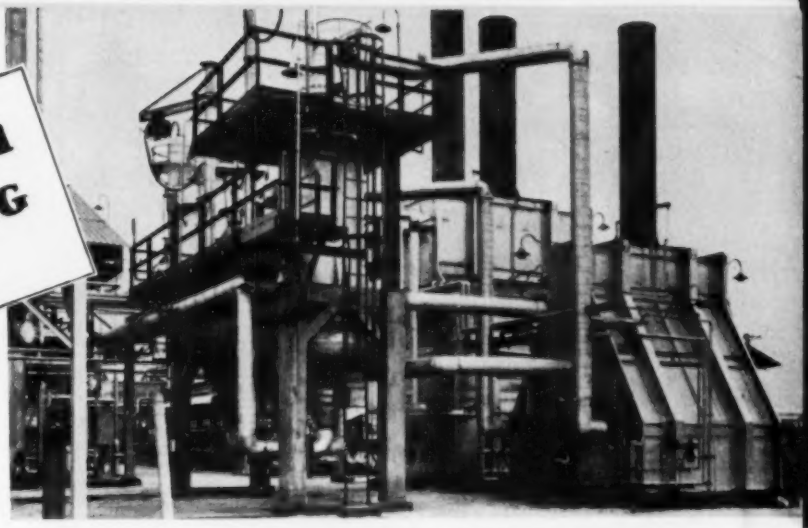
PETR CHEM
ISO-FLOW FURNACES
UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INCORPORATED
120 EAST 41ST STREET, NEW YORK 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston · Flagg, Brackett & Durgin, Boston · D. D. Foster, Pittsburgh · Faville-Levally, Chicago · Lester Oberholz, California

There's a Petro-Chem Iso-Flow Furnace and Boiler for every service, capacity or duty, irrespective of temperature pressure ranges . . . none too small or too large . . . more than 600 in operation throughout the world in the petroleum and allied industries performing with utmost satisfaction . . . and in many instances operating in excess of their design capacity by more than 50%.

PETROLEUM PROCESSING
APRIL, 1950



Here is the heart of the Old Dutch Platforming unit. In the left foreground are reactors in which the catalytic reforming operation takes place. At the left is an intermediate heater (for reheating the charge stock between reactors) and behind it the recycle gas heater

PLATFORMING

Operating Results and Design Details of First Commercial Installation of this New Catalytic Reforming Process for Upgrading Straight-Runs

By WILLIAM F. BLAND
Engineering Editor

LOW-QUALITY, straight-run gasoline is now being converted into high-octane premium fuel at the Muskegon, Mich., refinery of Old Dutch Refining Co. by the new catalytic reforming process—Platforming.

The Old Dutch installation is the first commercial unit put into operation, and has a capacity of 1500 b/d. The process was announced last Spring* by Universal Oil Products Co., and made available by them for licensing. The Old Dutch unit went on stream Oct. 28, 1949, and has been operating continuously since then, with only brief shutdowns for minor mechanical changes.

Octane improvement with Platforming, based on results obtained so far at Old Dutch, is exceedingly good, and product yields are high—in the order of 90-95% of gasoline with a clear Research rating of about 79-83. In addition, better than 90% of the original sulfur content of the straight-run gasoline is removed. As a result, lead susceptibility is also high—so that with 3 cc. of TEL the Research rating jumps to as much as 96.

Operating costs for a typical 1500-2000 b/d unit, UOP estimates, will run in the neighborhood of 30-37c per bbl. of feed.

Platforming—What Is It?

Platforming is a non-regenerative catalytic reforming process, which employs platinum as the catalyst.

The reforming reaction takes place under relatively mild conditions, about 900° F. and 750 psi. pressure, and in three reactors operating in series with intermediate heating. The intermediate heating is required because of the predominately endothermic nature of the reaction.

Platforming might perhaps be described as a continuously regenerative operation, rather than a non-regenerative one. Some carbon is formed during the reaction and deposits on the catalyst. Free hydrogen is also produced, however, and it is thought that under the pressure conditions maintained in the reactors the carbon is hydrogenated to methane (and possibly a small amount of other light hydrocarbons), and that once equilibrium conditions are attained the carbon is removed by hydrogenation as rapidly as it forms.

Three mechanisms are involved in the Platforming reaction, according to UOP engineers.

The first of these is dehydrogenation, in which the low-octane naphthenes in the straight-run gasoline charge stock are converted to high-octane aromatics, with the release of free hydrogen.

The second is hydro-cracking, which utilizes the free hydrogen produced in the dehydrogenation reaction, and in which the paraffins in the straight run are cracked and saturated to lower-boiling paraffins. These lower-boiling paraffins give the resulting product higher volatility, and also tend to offset the density increase resulting from the conversion of the naphthenes to aromatics.

The third is isomerization of the

*"New Catalytic Reforming Process Shows High Octane Gain, Low Volume Loss," PETROLEUM PROCESSING, 4, No. 4, 553 (1949).

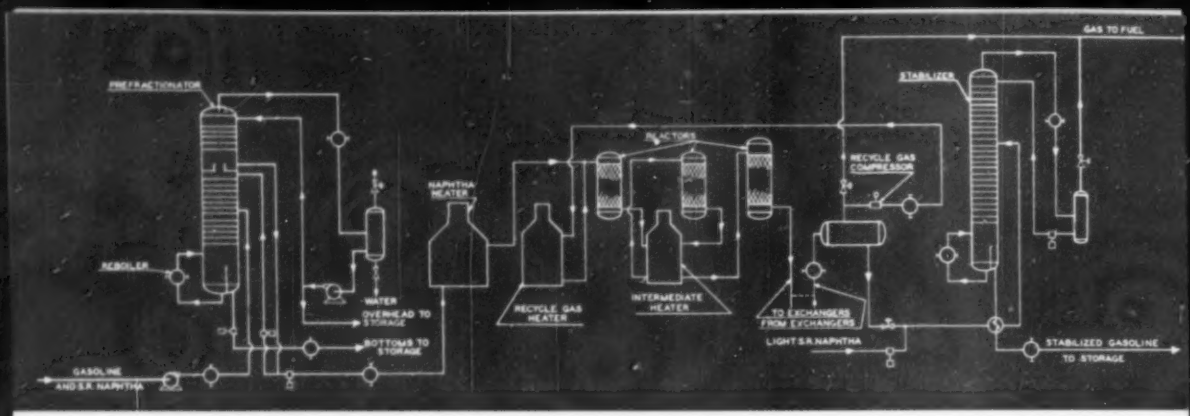


Fig. 1—Simplified flow diagram of the Platforming process as installed at the Old Dutch refinery at Muskegon

straight-chain paraffins to branched-chain isomers.

In addition, because the reaction takes place in an atmosphere of hydrogen, most of the sulfur content in the feed stock is hydrogenated to hydrogen sulfide. In a typical commercial operation at Old Dutch, a sulfur content of 0.08% in the charge stock has been reduced to 0.0019% in the product.

(A more complete discussion of the mechanisms of the Platforming reaction, effects of operating variables, and properties of the product are contained in a paper presented by Dr. Vladimir Haensel of UOP at the recent annual meeting of the Western Petroleum Refiners Assn. in San Antonio, Mar. 27-29. The complete text of Dr. Haensel's paper appears in this issue, beginning on page 357.—Ed.)

A "New Type of Gasoline!"

The product resulting from Platforming has been termed "platformate" by UOP engineers, and is described as a radically "new type of gasoline." They base their claim regarding the quality of platformate on the following points concerning its composition:

1) It is olefin-free (in contrast to gasolines produced by either thermal or catalytic cracking).

2) It is composed predominantly of iso-paraffins and aromatics, with a small amount of normal paraffins.

3) It is unusually low in sulfur—(90-95% sulfur removal is usually realized).

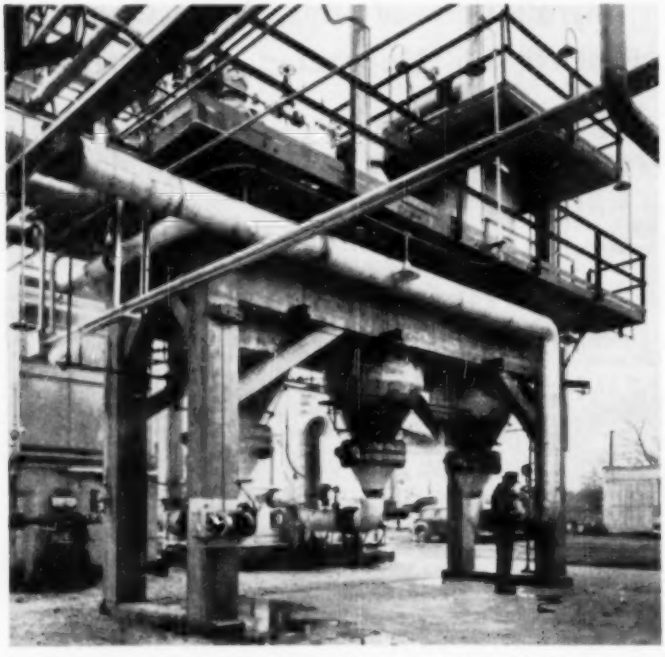
As a result of this composition, they say, platformate has

1) Better stability than cracked gasolines (being olefin-free).

2) Good lead susceptibility and utilization (being low in sulfur and olefin-free).

3) High octane rating (because of the aromatics and iso-paraffins).

Actual road tests, they also claim, have at all times shown platformate to have a higher road octane rating (by about 5 points) than would be predicted from a study of its Motor and Research octane ratings, and usually a Road rating that is even higher than the Research rating.



The Platforming reaction takes place in this group of three cylindrical reactors. Charge stock moves through each reactor in series, with intermediate heating to maintain the proper reaction temperature

Catalyst for Platforming

The catalyst employed in Platforming is, of course, the primary secret of the success of the process. And about the catalyst UOP is being discreetly silent, except to say that platinum is an important constituent.

UOP manufactures the catalyst itself—at present on a semi-commercial scale at its Riverside, Ill., laboratories. To meet increasing catalyst demands, UOP also has plans afoot for a full-scale commercial plant, although the company has as yet made no specific announcement regarding it.

(In this connection, it might be pointed out that about six months ago UOP announced that it had purchased 600 acres of land near Shreveport, La. Nothing further has been released by the company concerning its plans for that land—and it is quite possible that the catalyst manufacturing operations might be undertaken there.—Ed.)

Right now the big question mark hovering over the catalyst is its life expectancy. No one with UOP knows exactly how long it will last. The longest laboratory run on a single

batch of the catalyst has been five months—and even then the run was terminated not because the catalyst had lost its activity but because UOP desired to try out a new batch of the material. The Old Dutch installation had been running on the initial catalyst charge for more than four months at the time this article was written—and at that point the plant operators could detect no loss in activity.

It is expected that the catalyst life will be at least six months, probably a year, and possibly considerably longer. When it does have to be replaced, UOP will furnish a complete charge of new fresh catalyst in exchange for the spent material, giving the refiner credit for its platinum content. It is expected that nearly 100% of the original platinum can be recovered, since none is expended in the use of the catalyst and actual catalyst loss is negligible. UOP hasn't yet been able to secure any spent Platforming catalyst, in spite of runs in excess of five months, and therefore the company doesn't know whether it will be possible to regenerate spent catalyst or necessary to recover the platinum and use it in the manufacture of new catalyst.

Capital and Operating Costs

The cost of installing a Platforming unit is said to be one half to one third that for catalytic cracking. For a typical 1500 b/d unit (reactor charge capacity), the cost is estimated at $700,000; 3000 b/d for $1,200,000; 5000 b/d for $1,600,000; 10,000 b/d for $2,500,000.

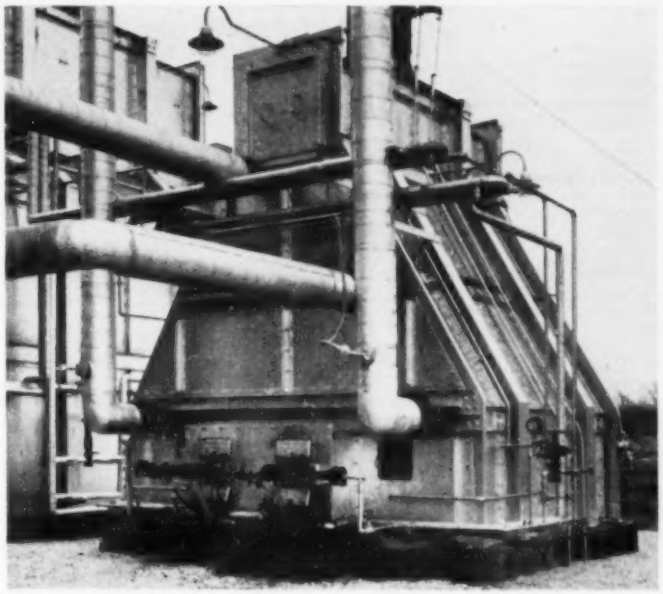
These figures are based on an all-new installation, and include all process equipment required for starting with straight run gasoline and ending up with stabilized platformate.

Operating costs will vary with local conditions and the type of crude run. For a typical 1500-2000 b/d unit, UOP engineers estimate that total operating costs would be 30-37c per bbl. of feed, when producing product with a minimum octane rating of 95 Research (including 3 cc. TEL).

These figures include 4-5c for labor, 4-5c for utilities, 3-5c for maintenance, 4-5c for taxes and insurance, 7c for royalty charges, and less than 10c for catalyst. The figures given for utilities do not include fuel gas for the heaters, since the process is self-supporting in that respect.

Operation of Old Dutch Unit

The Old Dutch unit has a design capacity of 1500 b/d, based on the amount of feed stock charged to the reactors. At present the company is charging about 700 b/d of straight-run gasoline purchased outside and 800 b/d of straight-run naphtha from its own crude unit.



Because the Platforming reaction is predominantly endothermic in nature, intermediate heating between reactors is provided by this end fired heater, with a dividing center wall. All heaters in the unit can be either gas or oil fired

The straight-run gasoline purchased outside has a boiling range of about 100 to 400° F., and a Research octane rating that varies from the low 40's to 55. The plant's own straight-run naphtha has a boiling range of 175 to 375° F., and a Research rating between 45 and 55. Sulfur content of both stocks ranges up to 0.08%.

The following description of the Old Dutch Platforming unit can best be followed if reference is made to the simplified flow diagram of the plant, Fig. 1, and the accompanying photographs.

Raw feed in the form of straight-

Naphtha heater, which takes the 175-375° boiling range side cut from the prefractionator and heats it to about 900-950° F. before it goes to the first reactor. This side fired heater has an input capacity of 7 x 10^6 Btu's per hour, and is the only major piece of equipment in the Old Dutch unit not installed new. It was previously used in a thermal reforming operation

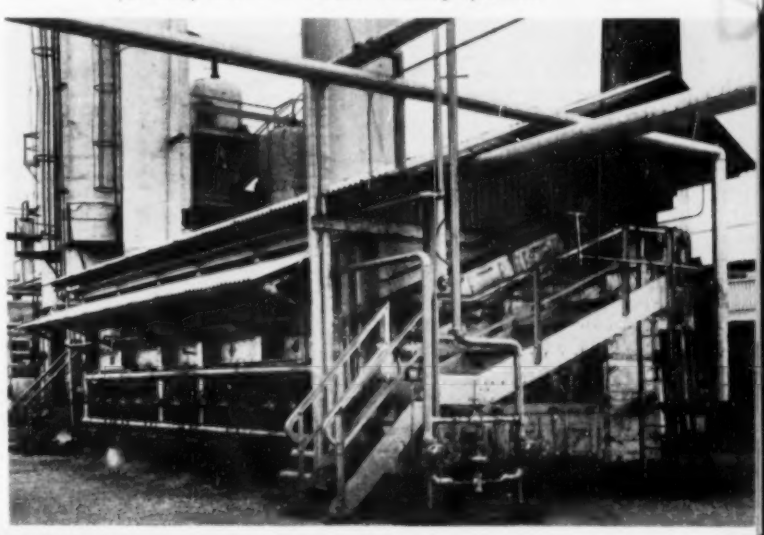
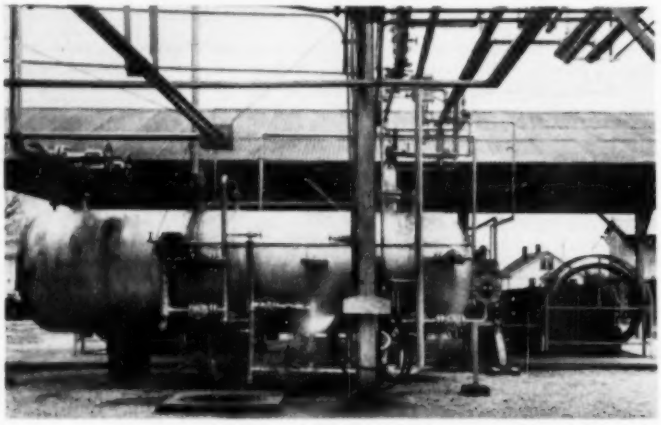


TABLE I—Performance Data, Old Dutch Platforming Unit

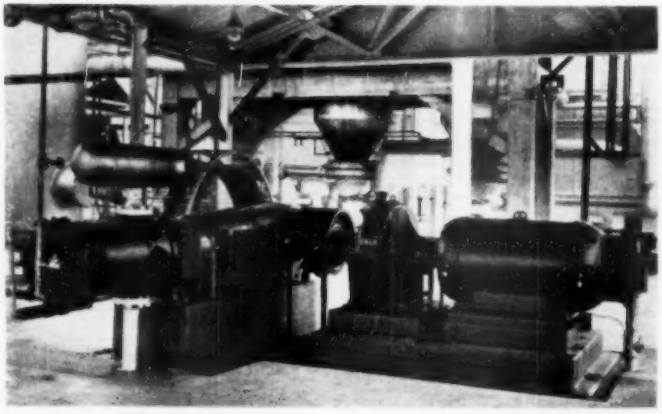
	1661-2057				1681-1701			
Hours on Catalyst								
Average Reactor Pressure psig	720				730			
Average Reactor Temperature, °F.	880				880			
Observed Rates and Yields:	b/d	Vol. % of Charge			b/d	Vol. % of Charge		
Reactor Charge	1533	100			900	100.0		
Stabilized Platformate	1420	92.6			850	94.4		
Calculated 10# RVP Platformate:			Vol. % of Charge				Vol. % of Charge	
Yield			97.1				97.3	
Outside Butane Required			4.5				2.9	
Inspection:	Reactor Charge	Stabilized Platformate	Calculated 10# RVP Platformate		Reactor Charge	Stabilized Platformate	Calculated 10# RVP Platformate	
Gravity, °API	58.1	57.4	59.7		59.5	60.4	61.7	
RVP	2.0	6.9	10.0		2.5	8.1	10.0	
Sulfur, %	0.08	0.0019			0.031	0.003		
Octane Ratings:								
Research, Clear	52.5	81.3	81.9		51.9	79.1	79.9	
+3 cc TEL	70.2	93.9	94.7		71.4	93.1	93.6	
Motor, Clear	48.9	75.5	76.1		48.3	75.8	76.7	
+3 cc TEL	68.5	87.4	88.2		70.2	87.6	88.3	
ASTM Distillation, °F.:								
IBP	166	110			160	103		
10%	203	155			196	148		
30%	225	195			217	184		
50%	248	225			239	214		
70%	273	260			266	246		
90%	309	308			304	297		
EP	355	363			340	350		
Component Yields:								
H_2 (SCF/Bbl.)		401				339		
C_1 (SCF/Bbl.)		80				66		
C_2 (SCF/Bbl.)		53				48		
C_3 (SCF/Bbl.)		65				55		
iC_4 (Vol. %)		2.1				1.3		
nC_4 (Vol. %)		3.5				3.4		
iC_5 (Vol. %)		5.0				5.1		
nC_5 (Vol. %)		2.9				3.3		
C_{6+} (Vol. %)		80.2				80.2		



run gasoline and straight-run naphtha is taken from storage, heat exchanged with product from the reactors to about 250° F., and fed to a prefractionator. The prefractionator column is 55½ ft. high, 5 ft. inside diameter, and contains 17 trays.

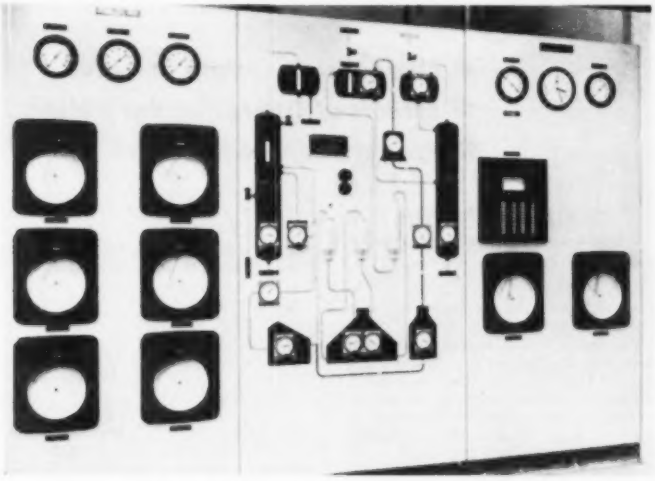
Purpose of the prefractionator is to separate out from the 400° E.P. feed a reactor charge stock of 175-375° F. boiling range. The column removes as overhead the light front ends, which wouldn't be improved much in the Platforming reaction. As bottoms it takes out any heavy material not separated in previous fractionations, as well as any contaminants picked up in storage or transfer.

To some extent, use of the prefractionator is precautionary. If material above the 375° F. range were allowed to get into the reactors it



ABOVE—Effluent from the third reactor, after being cooled by heat exchange, is fed to this gas separator, where uncondensed gases (80-85% hydrogen) are taken overhead and recycled. One of the compressors for handling the recycle gas can be seen at the right in the background

RIGHT—Recycle gas is compressed and returned to the incoming feed by two Chicago-Pneumatic single stage, double acting reciprocating compressors, one of which is shown here. In the background can be seen the lower cones of the three reactors



Instrumentation for the Old Dutch Platforming unit is grouped in this graphic-type panel, designed by Panellit. The unit was not yet on stream at the time this picture was taken, so instrument readings are not typical

would probably do no harm in small quantities for short periods, but in large quantities might result in a higher laydown of coke and shift in the balance between hydrogen production and coke removal. Extended periods of operation with much heavy material in the feed would eventually require shutdown of the unit.

The 175-375° F. side cut from the prefractionator is heat exchanged with reactor effluent to about 550° F. and then fed to a charge heater. The pump used for moving the reactor charge, which comes out of the heater at 700-750 psi. pressure, is a 3¼ in. diameter by 12 in. stroke Wilson-Snyder duplex pump, driven by a 60 HP constant speed electric motor operating through a hydraulic fluid coupling.

The charge heater is the only major piece of equipment in the unit which wasn't installed new. It is side fired, has an input capacity of 7 x 10^6 Btu's per hour, and was formerly used in an 800 b/d thermal reformer which Old Dutch previously operated. It was revamped by removing all tubes in the soaking section, and using only the radiant and convection banks.

Effluent from the heater, in the temperature range of 900-950° F., picks up recycle gas, of the same temperature range, and enters the first of the three reactors.

Each of the three reactors is cylindrical in shape, with conical top and bottom, and the third reactor is somewhat larger than the first two. Catalyst in each reactor is supported on alumina balls, which in turn rest on a heavy screen at the bottom of the reactor.

One heater, end fired, UOP design, with a dividing center wall, provides intermediate heating between the first and second and the second and third reactors.

Effluent from the third reactor is exchanged against five different streams (incoming raw feed, prefractionated feed, prefractionator bottoms reboiler, stabilizer bottoms reboiler, and recycle gas), cooled to about 100° F., and fed to a gas separator.

Uncondensed gases, containing 80-85% hydrogen and the balance light hydrocarbons (mostly methane), are taken overhead and recycled, with any excess being bled off and burned as fuel. Two Chicago-Pneumatic single stage, double acting reciprocating compressors operating in parallel handle the recycle gas. Each is driven by a 125 HP Louis Allis electric motor. The recycle gas is heated to 900-950° F. in a separate heater and fed to the first reactor with the heated reactor stock.

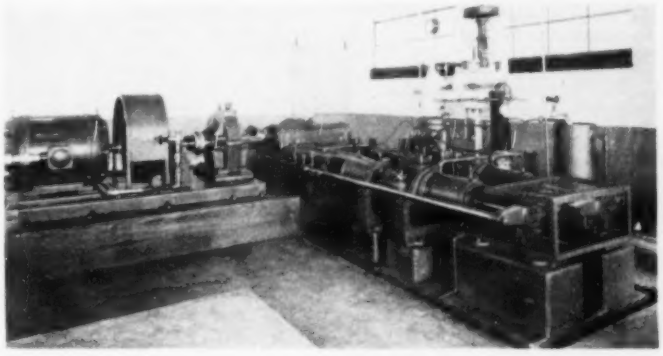
Liquid product from the gas separator is stabilized in a conventional stabilizer operation (62 ft. high, 3½ ft. inside diameter, 24 trays), and stabilized gasoline is run to storage. Overhead gases are cooled, condensed liquids returned to the tower, and uncondensed gases burned as fuel.

Performance data from the Old Dutch unit are given in Table 1, as supplied by UOP. These data would seem to be typical, since they correlate well with similar data obtained during an inspection of the plant and its operating records for an earlier period.

Instrumentation and Control

Instrumentation for the Old Dutch Platforming unit is centralized in a Panellit graphic-type control panel, which shows a flow diagram of the unit and has indicating instruments spotted on the diagram at key points. Recording instruments flank the central diagram panel.

Key process variables that are controlled are the oil temperature at the inlet to each reactor, and the system pressure. Reactor inlet temperatures are maintained by controlling fuel to the various furnaces. System pressure is maintained at a maximum of 750 psi. by a pressure regulator on the gas separator, set to bleed excess gas to fuel.



Charge stock to the Platforming reactors, at 700-750 psi. pressure, is pumped by this Wilson-Snyder duplex reciprocating pump, 3¼ in. diameter by 12 in. stroke. The pump is driven by a constant speed electric motor operating through a hydraulic fluid coupling

PLATFORMING

- **Chemical Reactions Involved**
- **Effects of Operating Variables**
- **Properties of the Product**

By VLADIMIR HAENSEL
Universal Oil Products Co.
Chicago, Ill.

AT THE last WPRA meeting, announcement was made of a new process for improving straight-run or natural gasoline. The process is called "Platforming" and represents the reforming of gasolines in the presence of hydrogen using a platinum catalyst.

It is well known that there are tremendous quantities of straight-run and natural gasoline stocks which are becoming less and less marketable because of their low octane number. The realization of this situation is not a sudden one, and the petroleum industry has been extremely active in attempting to convert these stocks into a suitable motor fuel. A tremendous amount of work has been done on non-catalytic processes such as thermal reforming and on catalytic processes such as hydroforming and desulfurization.

Although the thermal and catalytic processes have come into commercial application, they do not provide an ultimate solution for the production of high yields of high octane motor fuel from the straight-run and natural gasoline stocks. Over the years of research on the conversion of these materials into more valuable products, the fundamental ideas were formulated by our organization which outlined the ultimate goal and ways in which such a goal could be achieved.

First of all, it was realized that the ultimate process should be a catalytic one, free, as much as possible, from the undesirable thermal effects. The reason for this is that thermal treatment or a high temperature-high pressure treatment in the absence of catalysts gives rise to reactions which are difficult to control, and as a result a large portion of the liquid charge is converted into waste gas. Thus, it became apparent that in order to achieve this goal one had to operate using a catalyst at conditions under which thermal reactions are essentially absent.

Next, it was realized that such a catalytic process had to be made up of a number of chemical reactions since gasolines contain different hydrocarbon classes, each class requiring a different chemical reaction so that the members of this class can most efficiently be converted into more valuable components.

Furthermore, it became apparent that the rearrangement and conversion of the charging stock had to be extensive because there is no simple method of separating the products of the reaction from the charging stock.

Having established the fundamental principles of such an idealized process, it was necessary to find a suitable catalyst which could perform all these functions and at the same time have one other extremely important feature. This particular feature is the elimination of the need for catalyst regeneration, since regeneration is a costly and complicated operation. One merely has to consider the fact that no charging stock is processed over the catalyst during regeneration to realize that the efficiency of a nonregenerative operation and its inherent simplicity provides a practical solution for a refiner who cannot afford a large investment in a plant that remains non-productive for a good share of the time.

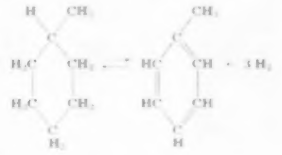
Over the past years, we have found that the Platforming operation approaches very closely to the ideal solution for the reforming of straight-run and natural gasolines. The functions of the catalyst in carrying out the desired reactions under conditions wherein wasteful side reactions are virtually eliminated have been realized in the laboratory, pilot plant and commercial operation.

At the present time, we wish to discuss the various phases of Platforming. These are:

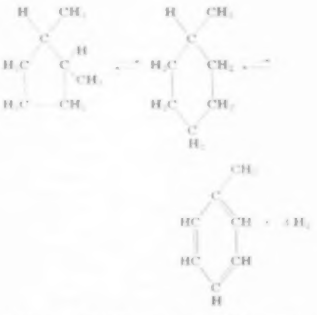
(1) The chemistry of the process
(2) Operating variables
(3) Properties of the Platformate
(4) Platforming of Mixed Straight-run Cracked Gasolines
(5) Economics of the Platforming Process
(6) Operation of the first Platforming unit at the Old Dutch Refining Company at Muskegon, Mich.

Chemical Reactions Involved

There are three major reactions which occur in Platforming of a straight-run gasoline. The first of these is the dehydrogenation of naphthenic hydrocarbons to the corresponding aromatic hydrocarbons. This is illustrated by the following:



wherein methylcyclohexane is converted to toluene and hydrogen. As is well known, straight-run gasoline contains a substantial amount of naphthenic hydrocarbons, of both the six-membered ring type and the five-membered ring type, and in the latter structure the dehydrogenation reaction is preceded by the isomerization reaction:



Under Platforming conditions the reactions of dehydrogenation of naphthenic hydrocarbons are very rapid and these reactions contribute substantially to the octane gain and heat of combustion of the gasoline. They are also highly endothermic; that is, they require a high heat input and they result in some volumetric shrinkage since the aromatic product is denser than the parent naphthene. Thus, for example, if the charge consisted of pure methylcyclohexane and if it were all converted to toluene, the theoretical yield of toluene would amount to 83.3% by volume of the charge with an octane number increase of about 50 units. The naphthenic content of straight-run gasolines varies considerably, but, assuming an average value of about 40%, the maximum volumetric yield due to dehydrogenation to aromatics

This paper was presented at the annual meeting of the Western Petroleum Refiners Assn. in San Antonio, Mar. 27-29, 1950.

would be about 93%, assuming complete conversion and no other reactions.

Another important reaction in Platforming is the opposite of dehydrogenation from the standpoint of yield and heat of reaction. This is the reaction of hydrocracking wherein a high molecular weight hydrocarbon is decomposed into lower molecular weight compounds. This is not the reaction of thermal cracking, where a paraffin is cracked indiscriminately along the hydrocarbon chain, nor is it the reaction of catalytic cracking where the product consists of lower boiling paraffins and olefins. It can be considered as a simultaneous cracking-isomerization-hydrogenation reaction, as shown by the following:

This reaction, as can be seen, produces isopentane and normal pentane from decane. In actual operation, the break in the molecule occurs not only in the middle, but also to the right and left of the center, so that butane and hexane, as well as propane and heptane, are formed also. Assuming for the time being that two pentane molecules are formed, the volumetric yield of such a reaction at 100% conversion is 118% along with an octane number gain of more than 100 units. As stated before, there is a small loss to propane and lower hydrocarbons, with the result that only a part of that high gain in volume and octane number can be realized.

It is, therefore, apparent that the hydrocracking reaction balances the dehydrogenation reaction in that it provides for a lower density product and absorbs a part of the hydrogen which is liberated in the dehydrogenation reaction. The reaction is also exothermic and, therefore, provides some of the heat of reaction required for the dehydrogenation step. The hydrocracking reaction is less rapid than the dehydrogenation.

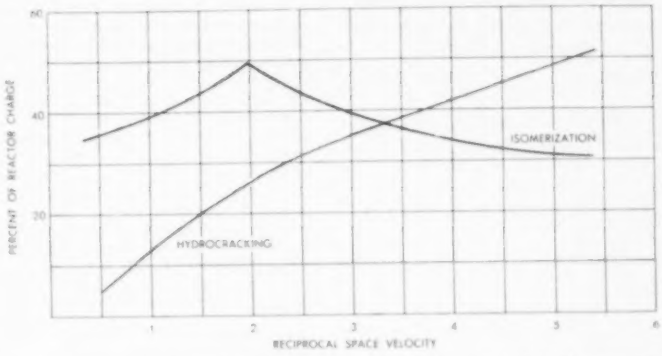


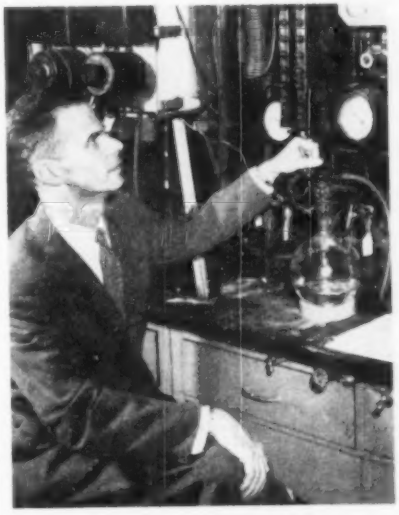
Fig. 1—Treatment of normal heptane with platforming catalyst in the presence of hydrogen

The third major reaction in Platforming is isomerization. This reaction was mentioned earlier, when it was stated that five-membered ring naphthenes undergo isomerization to six-membered ring naphthenes prior to the conversion into aromatics. Likewise, the isomerization of paraffins proceeds readily at Platforming conditions. In the case of normal heptane, this reaction is faster than hydrocracking as shown by Fig. 1, in which the extent of isomerization and that of hydrocracking are plotted against contact time measured as reciprocal space velocity. It will be observed that as the space velocity is reduced the extent of isomerization reaches a maximum value at a space velocity of about five. At lower space velocities the hydrocracking of the isomerized compounds reduces the net yield. The composition of the isomerized product is of interest in that nearly every possible heptane isomer is produced. Thus, at a space velocity of six, the composition of the heptane fraction exclusive of the normal heptane charged is as shown in Table 1.

The hydrocracking reaction which accompanies the isomerization reaction of heptane gives, as expected, propane and butane as the major products, the isobutane-normal butane ratio in the butane fraction being about one. Both higher and lower paraffins also undergo extensive isomerization.

In addition to the three major reactions that occur in Platforming, there are other important reactions. These include dehydrocyclization, wherein paraffins are converted directly to aromatics, and desulfurization, wherein virtually all of the combined sulfur is converted to hydorgen sulfide.

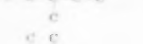
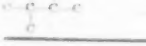
The question naturally arises as to how we balance the extent of the various reactions that take place in



Vladimir Haensel, Ph.D.

Vladimir Haensel received his B. S. from Northwestern University in 1935 and his M. S. from the Massachusetts Institute of Technology in 1937. He joined Universal Oil Products Co., assisting Professor V. N. Ipatieff. He received his Ph.D. from Northwestern in 1941, and returned to Universal as a Research chemist. From February to July, 1945, Dr. Haensel inspected the German synthetic oil plants as a member of the Technical Oil Mission for the Petroleum Administration for War. Since August, 1945, he has been the co-ordinator of the cracking research division of Universal Oil Products Co.

TABLE 1—Treatment of Normal Heptane with Platforming Catalyst in the Presence of Hydrogen

Compound	% in C_7 Cut Exclusive of n-C_7H_{16}
	46.2
	29.6
	10.9
	4.7
	4.4
	3.1

Platforming in order to attain the optimum yield octane relationship. This is accomplished primarily by proper selection and preparation of catalyst. Secondarily, the operating conditions are adjusted to give the desired product distribution.

It should be emphasized that Platforming is unique among reforming processes from the standpoint of low methane production. In a process of this kind, methane production is undesirable from the standpoint of severe loss of liquid product, high exothermicity of the reaction which forms methane and high hydrogen consumption. The extremely low methane production is beneficial on the basis of high liquid yield and control of the reaction at all times. For example, with other catalysts a high pressure condition leads to excessive methane formation and an exothermic condition is reached which is difficult to control. With the Platforming catalyst, on the other hand, a high pressure operation gives only a small amount of methane, and as the temperature is increased the selective hydrocracking reaction is quenched by the dehydrogenation reaction. Thus, there is no tendency to develop runaway temperatures in the operation of the Platforming process. In addition, it should be pointed out that another undesirable reaction, characteristic of some reforming processes, and involving the formation of high molecular weight compounds, is essentially eliminated in Platforming. Therefore, Platformates do not require rerunning.

Operating Variables

There are four major operating variables in Platforming. These are temperature, space velocity (which represents barrels of charge per hour divided by barrels of catalyst), pressure and hydrogen recycle rate. Over the past few years we have obtained a considerable amount of information both in the laboratory and in pilot plant operation concerning these variables with a number of commercial gasolines and pure compounds as charging stocks. The study of these variables as well as that of catalyst composition has been carried out in eleven laboratory and pilot plant units, ranging in throughput from one gallon to four barrels per day.

As might be expected, the relationships between these operating variables are extremely complex and it would not be practical in this paper to discuss the many details which are necessary to obtain a satisfactory correlation of operating conditions. We can only show certain illustrative effects of major variables but it should be pointed out that these effects are influenced to a considerable degree by the particular type of charging stock and the values of the other variables employed. When a major variable is changed it usually is necessary to make an adjustment in the other variables to obtain optimum performance, that is, optimum performance from the standpoint of yield-octane number relationship as well as from the standpoint of catalyst life.

These factors must be kept in mind when examining the data presented in the discussion.

Table 2 shows the results obtained in processing at various temperatures a 350° F. end point straight-run stock from mixed paraffinic and naphthenic crudes.

The results shown indicate first of all that Platforming is a relatively low temperature operation, and it is through the use of these mild conditions that the reaction remains a truly catalytic one, with no interference from undesirable thermal effects. The results also show the increase in the aromatization reaction as well as in hydrocracking with increased temperature at the operating conditions employed. Since both reactions contribute largely to the octane number gain it is not surprising that high octane numbers can be realized.

The effect of pressure as the major variable has been investigated and typical results are shown in Table 3. The charging stock consisted of a 247-404° F. Mid-Continent straight-run naphtha. It will be observed that a low pressure operation produced the most aromatics and the least amount of hydrocracking. At the highest op-

TABLE 2—Effect of Temperature in Platforming Reaction

	Charge	Run No. 1	2	3	4
Ave. Cat. Temp., ° F.	....	813	843	873	903
Yield of C_5+, Liq. Vol. % of Chg.	100.0	98.0	96.8	95.0	91.6
RVP	5.5	6.0	6.7	8.3	11.4
Octane Numbers:					
F-1 Clear	60.8	67.5	74	80.5	89
F-1 + 3 cc. TEL	80.2	85	88	92.5	98.5
F-2 Clear	60.7	65	70	75.5	82
F-2 + 3 cc. TEL	80.0	82	85	88	91.5
% Aromatics in Product	9	19	27	35	45
% Over @ 212° F.	21	34	36	41	46
Hydrogen Production, cu.ft./bbl.	....	166	318	420	466

TABLE 3—Effect of Operating Pressure in Platforming

	Charge	Run No. 1	2	3
Pressure, psig	....	500	700	900
Yields, Vol. % of Charge:				
C_5 + Platformate	....	92.6	92.9	93.2
C_5 + Platformate	....	86.5	86.1	83.5
10 lb. RVP Platformate*	....	97.3	96.4	92.4
Octane No. of 10 lb. RVP Platformate:				
F-1 Clear	30.6	85.1	84.1	84.8
F-1 + 3 cc TEL	52.8	95.2	94.3	94.9
% Aromatics, based on charge	7.1	53.9	47.9	45.4
% Over @ 212° F. + Loss	0	12.7	18.9	22.7
Hydrogen Production, cu.ft./bbl.	....	695	488	287

* With outside butane 4.7% at 500 psig. and 3.5% at 700 psig.

TABLE 4—Effect of Space Velocity, Catalyst "A"
(Mid-Continent Naphtha 230-395° F.)

	Charge	Test No. 1	2	3	4
L.H.S.V.	....	4.9	3.9	3.0	1.9
C_5 + Yield, Vol. %	....	95.6	95.4	95.1	94.1
RVP	....	4.5	5.2	6.4	6.9
F-1 Clear	35	70	74	78.5	82
F-1 + 3 cc TEL	59.5	88	89	90.5	93
% Aromatics in Product	7	37	39	39.5	41
% Over @ 212° F. + Loss	....	8.3	13.5	16	24
H_2 Production, cu.ft./bbl.	....	495	475	470	430

TABLE 5—Effect of Space Velocity, Catalyst "B"
(Mid-Continent Naphtha 230-395° F.)

	Test No. 1	2	3
L.H.S.V.	2.0	3.0	4.0
C_5 + Yield, Vol. %	91.8	93.9	95.1
RVP	12	10	6.9
F-1 Clear	85	81	76
F-1 + 3 cc. TEL	95	93	90
% Aromatics in Product	43	40.5	38
% Over @ 212° F. + Loss	32	25	17

TABLE 6—Desulfurization Effects of Platforming

Crude Source	Sulfur in Charge, %	Sulfur in Product, %	Sulfur Reduction, %	Octane Rating, F-1+3 cc. TEL
Michigan	0.045	0.0027	94	96
Gulf Coast	0.019	0.0023	88	93
Mid-Continent	0.040	0.0042	90	95
California (1)	0.102	0.0005	99	95
California (2)	0.14	0.0036	97	97

TABLE 7—Storage Stability Tests with Platformate

	Start	2 Mo.	4 Mo.	6 Mo.	9 Mo.
Peroxide No.	0.1	0.98	0.7	0.8	0.7
Induction Period, Min.	>1020				
ASTM Gum	0	1	0	0	1
Color, Saybolt	21	17	15	15	15

erating pressure shown in the table, 900 psig., a larger part of the improvement in octane number is due to the hydrocracking reaction, since in this case the amount of hydrocracked material (as measured by percent over at 212° F.) is almost twice that obtained at the lowest pressure. The yield of butane is large at the highest pressure and in this particular case a small butane excess was obtained over that required for 10 lb. RVP gasoline.

Thus, it becomes apparent that by varying the operating pressure the Platforming operation can be carried out to produce either a more aromatic gasoline, which means more hydrogen production and a gasoline of lower volatility, or a more volatile product with a lower aromatic content and lower hydrogen production.

The range of pressure used in the Platforming operation is limited at the higher value by economic considerations as well as by temperature required to produce a given quality Platformate. As the pressure is increased a limit is reached where thermal reactions may occur to such a degree that the yield-octane relationship deteriorates. The lower pressure limit is set by the decrease in the desired amount of hydrocracking as well as by possible carbonization of the catalyst. The lack of carbon formation in the Platforming operation is due to the continuous prevention of formation of materials which lead to carbon, this prevention being carried out by hydrogen. If the partial pressure of hydrogen is maintained at a low value over prolonged periods of time there is a tendency for carbon formation to occur. Such a condition is prevented by providing a reasonable recycle gas rate thereby making the process a truly non-regenerative one.

It has been pointed out earlier that the dehydrogenation reaction is a relatively fast reaction while hydrocracking is considerably slower. A study of the effect of space velocity substantiates this statement. Tables 4 and 5 show the results obtained in processing a Mid-Continent naphtha at various conditions in which space velocity was a principal variable. It will be observed that, according to Table 4, a change in space velocity from about 5 to 2 increased the extent of hydrocracking three-fold (as measured by percent over at 212° F.), while the aromatization reaction, already very extensive at the highest space velocity, was affected only slightly. The results obtained with a somewhat more active catalyst are shown in Table 5, where a higher octane number is reached at the same operating conditions. These results are also summarized in Fig. 2, correlating the research octane numbers and reciprocal space velocity.

The discussion of the effect of operating variables brings out also the flexibility of operation. As has been shown, we can vary the ratio of the reactions that occur in Platforming so that it is possible to obtain a number of volatility-octane relationships instead of one single relationship as is true in the case of thermal reforming. This flexibility of operation permits us to produce fuels that have a range of volatilities depending upon the over-all refinery economics.

Properties of the Platformate

The previous discussion has dealt with the product of Platforming from the standpoint of aromatic concentration, volatility and octane number. At this point it is worthwhile to mention briefly some of the other properties of the platformate.

Table 6 shows the sulfur contents of the charging stocks and products and the corresponding leaded research octane numbers at a variety of severities.

The results shown in Table 6 indicate that the sulfur removal from different stocks varies from 88 to 99%, the initial sulfur content having no bearing on the extent of desulfurization. In other words, high sulfur stocks are desulfurized to the same extent as low sulfur stocks.

A number of storage stability tests have been made on platformates produced in pilot plant operation. Table 7 gives a summary of the storage results using a platformate from a Michigan stock. The tests were made in vented bottles at 100° F. and no inhibitor was added.

It will be observed that the platformate is very stable in storage. The addition of inhibitor is required only for the purpose of retaining tetraethyl lead in solution in the same manner as is necessary for straight-run gasoline. A slight drop in color has been observed to occur over the period of storage.

A considerable amount of work has been done by our Automotive and Aircraft Department in connection with the road performance of a variety of platformates. It is planned to present a paper shortly dealing with the properties and performance of platformates; therefore, only brief mention of the subject will be made at this time. It is known that most gasolines have a road performance equivalent to a value between the research and the motor octane numbers. It has been found that platformates have a road performance value which equals or substantially exceeds the research octane number.

Platforming Mixed Straight-Run Cracked Gasolines

The inclusion of an olefin containing material in the charge to a Platforming unit results in the formation of a product very similar in quality to that produced from straight-run

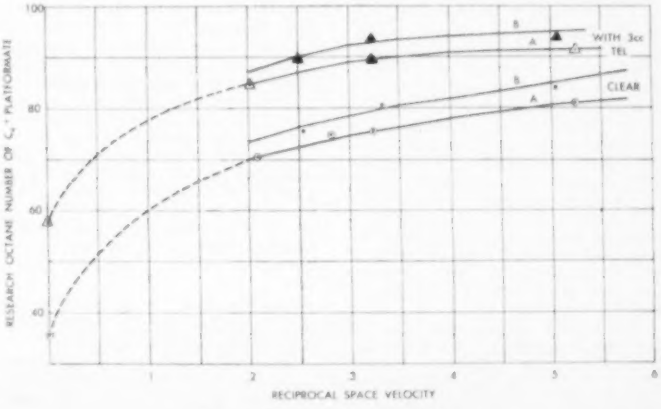


Fig. 2—Effect of space velocity

TABLE 8—Platforming of Cracked Naphtha

	Charge	Run No. 1	Run No. 2	Run No. 3
Boiling Range, ° F	275-387	133-420	117-420	106-426
Octane Numbers:				
F-1 Clear	60.2	74.9	79.6	89.1
F-1 + 3 cc. TEL	77.8	87.9	97.6	98.6
% Sulfur	0.45			0.0045
Bromine Number	56	2	1	1

TABLE 9—Platforming of a 50:50 Blend of Cracked Naphtha and Straight-Run Gasoline

	Charge	Run No. 1	Run No. 2	Run No. 3
Boiling Range, ° F	192-394	108-407	105-408	88-406
Octane Numbers:				
F-1 Clear	55.9	78.2	84.4	89.9
F-1 + 3 cc. TEL	69.0	90.9	94.8	97.9
% Sulfur	0.33		0.0036	

TABLE 10—Operating Costs for Platforming Unit with 1500-2000 b/d Charge Capacity

	Cents/barrel reactor charge
1. Operator and part time helper per shift	4-5
2. Maintenance	3-5
3. Taxes and insurance	4-5
4. Utilities	4-5
5. Catalyst	<10
6. Royalty (escalator)	7
Total	30-37

stocks alone. In view of the fact that the lower boiling fraction of thermally cracked gasoline, that is the material boiling below about 200° F., is a good fuel from the standpoint of octane number, only the higher boiling fraction of thermally cracked gasoline should be included in the charge to the Platformer. The higher boiling fraction from thermally cracked gasoline is, on the other hand, a poor fuel from the standpoint of octane number, sulfur content and storage stability. The conversion of this fraction to a platformate type of gasoline eliminates all these undesirable properties.

Since olefin-containing stocks usually cannot produce as much hydrogen as straight-run gasolines, the processing of cracked gasoline in admixture with straight-run is normally desirable from the standpoint of maintaining a high hydrogen concentration in the recycle gas. The processing of blends containing equal parts of cracked and straight-run naphthas proceeds very satisfactorily with a substantial hydrogen production.

To illustrate the Platforming of cracked stocks Tables 8 and 9 give the results obtained in processing a West Texas cracked naphtha alone and a blend of equal parts of full-boiling range West Texas straight-run gasoline and cracked naphtha. We have obtained data on the Platforming of a West Texas straight-run gasoline and found that it undergoes a normal upgrading in quality.

The results indicate that thermal gasolines are very susceptible to Platforming and very high octane number fuels have been produced. The reduction in sulfur content should be of interest in a number of refineries where high sulfur crudes produce a high sulfur gasoline on thermal cracking.

We have also investigated the properties of the blend of the Platformed cracked naphtha with the untreated lower boiling fraction of the cracked gasoline. It was found upon comparing the road performance of this blend with the road performance of the original full-boiling range thermal gasoline that the material containing the Platformed fraction was superior to the thermal gasoline by a margin exceeding fifteen octane numbers.

Economics of the Process

The economics of any process is, of course, of major importance to the refiner. It is not the purpose of this paper to go into details of the economics of Platforming, but merely to point out the over-all picture.

The exact prediction of the economics of any proposed installation depends on an accurate forecast of the market for and the prices of both the charging stock and the product over the period of the life of the plant, which is obviously impossible. We can, however, make certain generalizations which are believed to be accurate:

1. The present trend to emphasize quality will continue. This will result in an increasing differential between the values of charge and of product.

2. The refiner who operates the process which can produce the highest quality product will be best able to survive in a competitive market.

3. The process which has the better yield-octane relationship will have the better economic advantage.

4. As has been shown in the data presented in an earlier section of this paper, Platforming provides for an extremely high volumetric recovery of an exceptionally high quality gasoline produced in a simple unit having a low operating and capital cost.

The operating cost of a Platformer that has a capacity of 1500-2000 b/d is shown in Table 10.

The figures shown are somewhat conservative. The value given for utilities does not include the fuel gas; however, we do find that the Platforming process is normally self-supporting from the standpoint of the heaters' fuel gas requirements.

Estimates have been made for the cost of Platforming units. Naturally, these values will vary depending upon the local conditions. However, assuming an average labor cost in the Mid-Continent area and all new equipment these values range from about $700,000 for a 1500-b/d (charge to reactors) unit to $1,600,000 for a 5000-b/d unit and $2,500,000 for a 10,000 b/d unit.

Commercial Operation

At this time it is of interest to describe briefly the progress of the first commercial Platforming unit at the Old Dutch Refining Co., Muskegon, Mich.

(The preceding article in this issue, written by PETROLEUM PROCESSING's engineering editor after a personal inspection of the Old Dutch installation and talks with both UOP and Old Dutch engineers, gives further details on the design and operation of the unit.—Ed.)

The unit was started on Oct. 28, 1949, and has been in essentially continuous operation since that time, charging on the average 900-1000 b/d of a 180-360° F. naphtha. More recently the throughput on the plant has been increased to about 1500 b/d.

Performance of the plant has been highly satisfactory and, except for a few mechanical troubles which usually accompany the first try-out of any new equipment, the operation has proved itself to be exceedingly simple. The operation has been conducted at 860-890° F. average catalyst temperature and 700 psig. pressure.

It is interesting to note that the original plan was to operate to obtain a product with a leaded research octane number of 89-90. However, during the intervening period of construction, which required 139 days, the refiner was called upon to produce a considerably higher octane product. As a result, the unit has been operating at somewhat different conditions to produce a leaded octane level of 93 with a yield of 94.5 vol. %. At one time the unit was operated for a period of several weeks to produce a Platformate having a leaded octane number of 95.8 with yield of 90 vol. %. The total gas production amounts to about 900,000 cu. ft. per day, of which more than one-half is vented from the separator and contains 80-85% hydrogen. The remaining gas is vented from the stabilizer overhead.

Acknowledgment

The development of the Platforming process is the result of intensive work on the part of many in the Universal organization, and I should like to express my appreciation to my colleagues for their wholehearted co-operation.

GRAPHIC PANELS

The New Look in Instrumentation

By WILLIAM C. UHL, Equipment Editor

Regarded by many engineers and plant management personnel as one of the more significant developments of recent years, the graphic panel idea has been given its greatest impetus by the petroleum processor, who wants accurate, rapid, automatic control and close supervision of a complex process, or perhaps of a series of integrated complex processes.

A recently completed survey indicates that instrument engineers, consultants, and individual instrument manufacturers have all responded to the needs of this problem. This article traces the development of the graphic panel to what it is today, describing the latest designs and newest individual instruments being introduced on the market. It tells of some of the problems still to be solved and what the refiners are thinking and doing about graphic panels.

THE petroleum processing industry is turning with increased interest and activity toward use of the new graphic type instrument panels for the control of individual units, general processing areas, and even complete refineries. A survey just completed by PETROLEUM PROCESSING discloses that:

1—Fourteen oil companies have installed or already placed on stream new processing units controlled by the newest type graphic panels.

2—Ten other refiners report the new panels are under investigation and plans being made for their probable installation, at least in modified form, in future expansion or in changes at existing plants.

3—Of these ten, seven companies said that earlier, simplified forms of graphic panel instrumentation have already been developed and used in their refineries during the last few years.

The extent to which graphic panels are being used and the type and capacity of the plants in which they are installed is shown in Table 1. In general, the panels are employed to the greatest extent in completely new plants or by the smaller refiners, who are seeking every possible way to cut costs and streamline their operations. However, as can be seen from Table 1, Sun Oil Co.'s 30,000 b/d Houdriflow cracking unit at Toledo and Esso Standard Oil Co.'s 41,000 b/d Fluid unit at Bayway, by no means small operations, have installed graphic-type panels. The other large oil companies state they are watching developments closely and are conducting thorough studies of the merits and shortcomings of graphic panel design.

The refiner of today who is considering seriously the installation of a graphic panel is looking for the answers to such questions as:

What is the past history of the graphic panel? How did it get started? How has it been developed to its present stage? How has it been used?

Where does it stand now? Who is using it? Who plans to use it? What are the designs and types now in use and on the market? How much does it cost—more or less than conventional panels? What are its shortcomings? What do other oil companies think of it? What new devices have been developed for specific use on the graphic panel?

And how about the future? What are some of the problems still to be solved? What potential further applications exist? Where can the new approach in instrumentation be expected to lead us?

In order to find the answers to at least a few of these questions, PETROLEUM PROCESSING has gone into the field and discussed the graphic

TABLE 1—Installations of Graphic-type panels

Company	Process Unit	Capacity	Panel Design	Status
Sun Oil Co., Toledo, O.	Houdriflow Cat. Cracking	30,000 b/d	Sun-UOP-Houdry-Panelbilt	installed
Tide Water Associated Oil Co. Drumright, Okla.	Houdriflow & Gas plant	4,500 b/d	UOP-Panelbilt	installed
Old Dutch Refining Co. Muskegon, Mich.	UOP Platformer	1,500 b/d	UOP-Panelbilt	onstream
Rock Island Refining Co. Indianapolis, Ind.	Entire ref'y. incl. UOP Fluid cat.	10,000 b/d	UOP-Panelbilt	onstream
Wood River Oil & Refg. Co., Hartford, Ill.	UOP Fluid cat.	7,500 b/d	UOP-Panelbilt	installed
Globe Oil & Refining Co. Lemont, Ill.	UOP Fluid cat.	6,000 b/d	UOP-Panelbilt	onstream
Cosden Petroleum Corp. Big Spring, Texas	UOP Fluid cat.	6,000 b/d	UOP-Panelbilt	onstream
Deep Rock Oil Co. Cushing, Okla.	UOP Fluid cat.	5,000 b/d	UOP-Panelbilt	installed
Indiana Farm Bureau Evansville, Ind.	UOP Fluid cat.	4,000 b/d	UOP-Panelbilt	installed
Standard Oil Co. (Ohio) Lima, Ohio	Lube oil	.....	Sohio-Lummus-G-E	installed
Pan American South. Corp. El Dorado, Ark.	Delayed coker	5,300 b/d	Lummus	installed
Esso Standard Oil Co. Bayway, N. J.	Fluid cat.	41,000 b/d	Esso	onstream
Shell Oil Co. of Canada Montreal, Que.	Solutizer Treater	7,000 b/d	Shell	installed
Salt Lake Refining Co. Salt Lake City, Utah	Houdriflow Cat. Cracking	10,000 b/d	Brown	being built

In addition to the above, Lummus Co. reports three graphic panels installed in foreign refineries: one on a lube oil plant in The Netherlands; and two in a French refinery, one on a combination atmospheric and vacuum distillation unit and the other on a lube unit covering propane deasphalting, furfural solvent extraction, solvent dewaxing, wax crystallization, and contact filtration.

panel with instrument designers, makers, and users. A careful appraisal and a progress report at this time is believed very much in order. Graphic panels will have a number of interesting effects not only on trends in instrumentation but also on plant design and operation, it is believed.

Some of the facts and opinions brought out in this survey are:

1—Graphic panels are being built at a cost equal to or less than conventional instrument boards. One refiner found a graphic console type panel effected a saving of over 15% in the total instrumentation charges on a specific process area.

2—Recent installations of graphic panels have been accomplished in very short periods of time, as little as seven hours at one refinery.

3—They permit smaller control buildings. A midwestern refinery reduced the floor area requirements of its control building by nearly 70%. Another plant saved 50% in panel space.

4—Some economies, however, cannot be attributed to the graphic panel proper. For example: the new small-scale, or miniature panel instruments can also be used on a board without a pictorial flow diagram, in which case even greater space savings could be realized. Also, the lower-cost, non-indicating transmitters being utilized on graphic panel systems can also reduce costs on conventional panel systems. Finally, some operators feel that conventional boards might be rearranged to obtain material space savings.

5—Better over-all control of processes is possible with the graphic panel. This may lead to the employment of such panels for controlling entire plants. With the various units in the refinery fully integrated into one continuous operation intermediate and surge tankage might gradually be reduced. As one engineer described it, a refinery could become nothing more than a "bulge" in the pipe line from the well to the consumer.

6—In addition to the high level of activity by refiners, five major refinery engineering firms have been participating in graphic panel development, and several leading instrument manufacturers have announced that packaged panel designs will be available in the near future. A number of new miniature instruments have been designed for specific use on graphic panels.

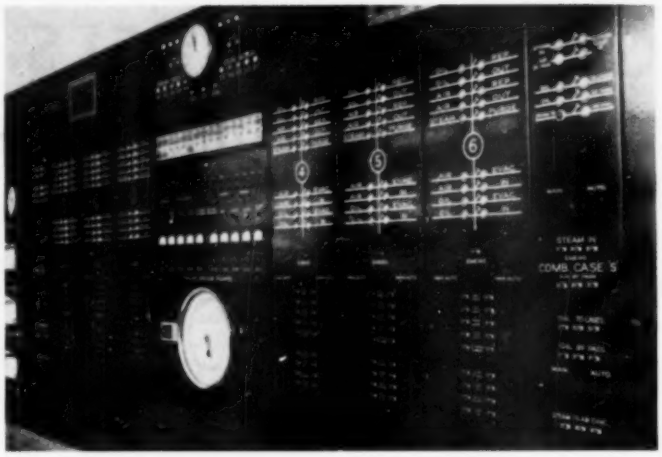


Photo courtesy of Houdry Process Corp.

Fig. 1—The first Houdry fixed bed catalytic cracking unit with automatic instrumentation at Sun Oil Co.'s Marcus Hook refinery used this early "graphic" panel

When Did Graphics Start?

Historically, the idea is not new of a visual kind of control panel which attempts to incorporate a flow diagram of the process with the instruments which govern that process. There is somewhat sketchy information on the exact beginnings, but one of the earliest uses of a simplified flow diagram on a refining unit instrument panel was in the Houdry fixed bed catalytic cracking units. Designed by Sun Oil Co., the first such panel was installed on their original Houdry unit built in 1937 at Marcus Hook, Pa. It is illustrated in Fig. 1.

This forerunner to today's graphic panel was mainly a board with indicating instruments, alarm lights and signals, and push button valve controls at appropriate points on a simplified diagram of the unit drawn directly on the panel. In some cases, different colored lights were used to indicate the various streams. Coupled with an automatic cycle timer, the panel represented complete control of this second commercial catalytic cracking unit.

During 1940, Esso Standard Oil Co. in cooperation with M. W. Kellogg Co. and other firms began experimenting with graphic panels for another cyclic type process. The first hydroforming unit, a full-scale demonstration plant put into operation at Esso's Bayway refinery, employed

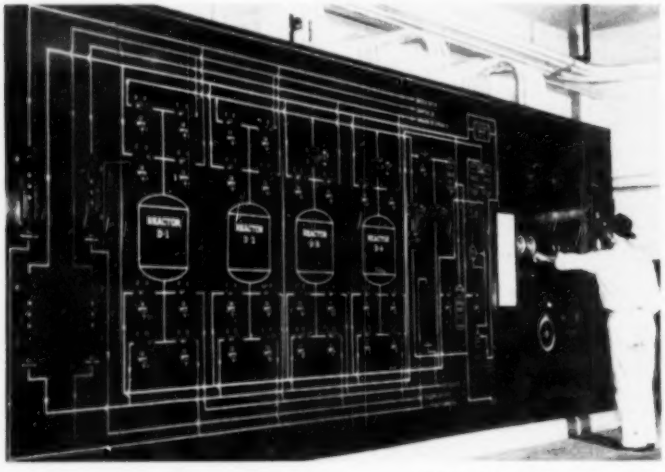


Photo courtesy of M. W. Kellogg Co.

Fig. 2—Hydroforming units employed another early form of graphic panel to govern the time cycle process. This is a panel at Pure Oil Co.'s Toledo refinery

a control board engineered by Kellogg and General Electric Co. which was similar to the earlier Houdry panels. Numerous counterparts of this panel have since been installed on various other hydroforming units around the country. Pure Oil Co.'s Toledo refinery includes a hydroforming unit controlled by the panel shown in Fig. 2.

The development of the synthetic rubber program during 1942, involving petroleum hydrocarbons as raw materials, produced still further work on graphic panels. Again a time cycle control design was the result, in this case for butene dehydrogenation. Three such panels—at the Baton Rouge and Baytown synthetic rubber plants—were designed and engineered by Esso Standard Oil, E. B. Badger & Sons Co., and Automatic Temperature Controls, Inc. A typical panel was made of sheet steel, 6 ft. 9 in. high, 6 ft. wide, and in a black enamel finish. (See Fig. 3.)

A color-coded flow chart was painted on the panel in yellow, green, white, and red. Indicator lights, push buttons, and a selector switch for manual or automatic operation easily identified various actions in the process. Large dials in the center of the symbols for the vessels showed the progress of the cycles. The panel included considerable mechanism behind the front, being 5 ft. 4 in. deep.

None of these three time cycle panels—Houdry, hydroformer, or butene dehydrogenation—included such component instruments as are used today; for example, pressure, flow, temperature, or liquid level indicators and controllers. That kind of function was continued on conventional instrument panels adjacent to the panels described.

One of the first installations in which a variable was covered in a visual type panel was in Thermofor catalytic cracking units built at Gulf Oil Corp. refineries in 1943. Continuous close control must be exerted over the burning zones in the catalyst regenerator. Gulf has three thermocouples spotted in each of eight zones, making a total of 24 for the kiln. Safe, efficient operation of the kilns requires a continuous indication of the temperatures in all zones. This is obtained by a unique arrangement of the indicators on a part of the instrument panel covering the regenerator, as shown in Fig. 4.

An outline of the kiln is stencilled directly on the face of the panel and indicates the location of thermocouples and control valves. To the right of this diagram are 24 temperature indicating scales, graduated from 800 to 1400° F. The scales are in groups of three for each zone, with the top indicating pointer in each group colored red, the middle pointer blue, and the bottom yellow. Not only can the operator ascertain the three temperatures in each zone, but also in one rapid glance down the panel, he can note the pattern of temperature distribution throughout the eight zones of the kiln since the pointers literally line up to form a continuous temperature distribution curve.

The system was plant-built by using the scales, pointers, slidewire and associated parts of 24 Brown "Electronik" potentiometers together with the converter and amplifier unit of one high-speed Brown Electronik potentiometer. A stepping switch automatically selects a new thermocouple and slidewire every ten seconds, thus requiring four minutes to scan the entire unit.

The instruments on either side of the temperature indicating scales are remote manual control stations for operating the diaphragm motor valves which control the kiln temperatures.

The years following the close of the recent war were marked by considerable development activity on graphic panels, culminating in one case in a design disclosed at the 1949 meeting of the Instrument Society of America last September in St. Louis. A paper by David M. Boyd, Jr., of Universal Oil Products Co., described a panel designed by UOP and built by Panellit, Inc. For the first time, provision was made

Fig. 3—Left: butene dehydrogenation, for synthetic rubber manufacture, utilized a graphic panel like this to operate a time cycle control

Fig. 4—Right: unique arrangement of temperature indicators shows the temperature distribution curve of a TCC unit regenerator in a Gulf Oil Co. refinery

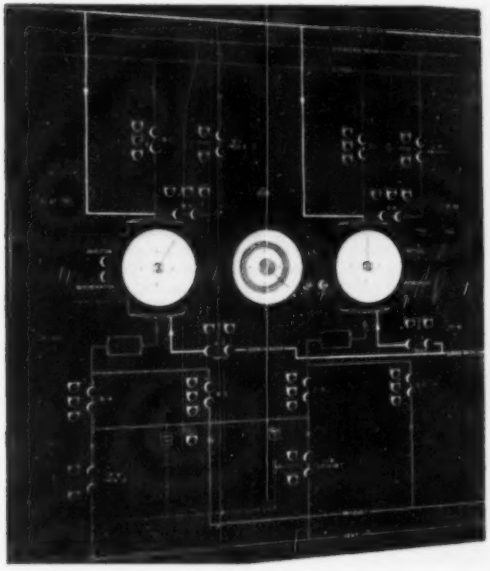


Photo courtesy of Automatic Temperature Controls

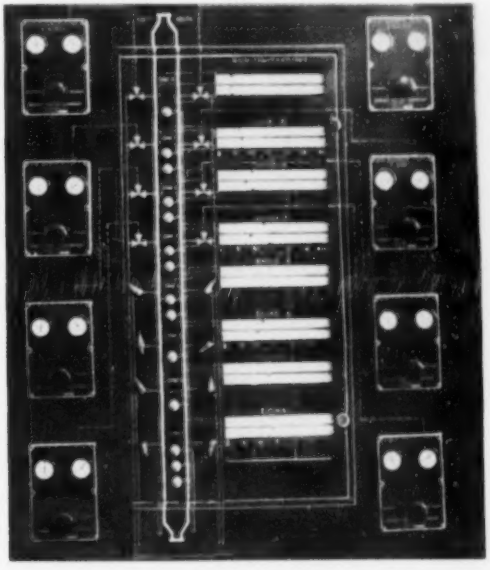


Photo courtesy of Brown Instrument Co.

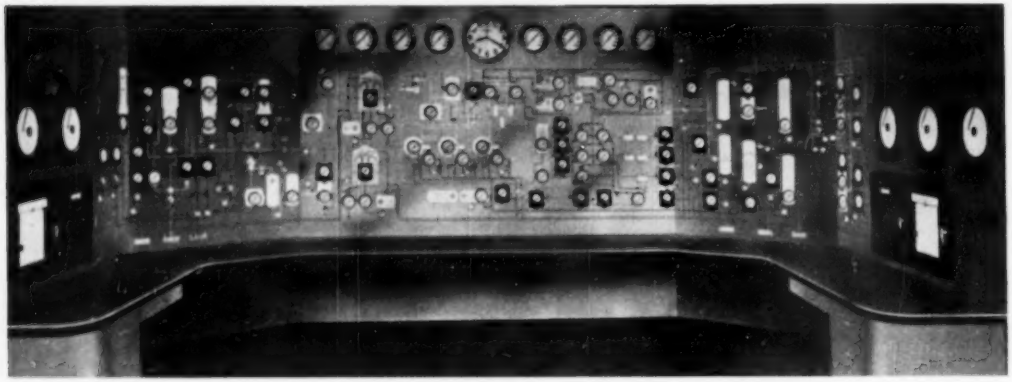


Photo courtesy of General Electric Co.

Fig. 5—The graphic console type panel built for Sohio's lube oil unit at the Lima refinery

for the complete control of an entire refinery, Rock Island Refining Co.'s Indianapolis plant. Panellit exhibited a smaller panel of the same type, built for a UOP-Fluid catalytic cracking unit at Wood River Oil & Refining Co., Hartford, Ill., and announced work was underway for further installations in five other refineries. (See PETROLEUM PROCESSING: Sept., 1949, pp. 979-980; Oct., 1949, pp. 1097-1100; and January, 1950, pp. 45-48). Three new panels are reported by Panellit to be under consideration: Great Lakes Refining Co., Blue Island, Ill., UOP Fluid Cracker; National Cooperative Refinery Ass'n., McPherson, Kans., UOP Fluid Cracker.

Sohio's Lube Unit Panel

During the discussion period following Mr. Boyd's ISA paper at St. Louis, Walter S. Bowers, instrument engineer, Standard Oil Co. (Ohio), revealed that another graphic panel design was being installed at Sohio's Lima, Ohio, refinery, for the control of a lube oil unit. Designed by Sohio in cooperation with Lummus Co. and General Electric, the panel incorporates some further innovations in visual control instrumentation.

The Sohio panel, a U-shaped console type, is illustrated in Fig. 5. Process units covered by the board are a furfural solvent refining unit and an M.E.K. solvent dewaxing unit.

Instrumentation contained in the main console would have required a 62-ft. long board using conventional design, and would have required a 40-ft. square building. The console panel is approximately 28 ft. long and fits into a building approximately 18 x 28 ft.

The company realized an over-all saving of better than 15% of the total cost of instrumentation through use of the graphic console. Main points of savings, as reported by Sohio engineers, were as follows:

1—$13,000 savings in the cost of the control house. A conventional instrument panel would have required a building costing over $20,000; the house as built for the console cost less than $7,000.

2—$5,000 saving through use of less expensive indicating instruments made possible with graphic type panel.

3—$2,000 savings through use of a prefabricated console, which is shipped as a package unit from the manufacturer and installed completely assembled at the plant, requiring only air, electrical, and control tubing connections.

4—Several other minor items, including use of inter-changeable instrument components, smaller inventory of repair parts, etc.

Esso's Fluid Unit Panel

Another approach to graphic panel design is an instrument board at Esso Standard Oil Co.'s Bayway refinery on the new 41,000 b/d Fluid catalytic cracking unit. This panel, shown in Fig. 6, is not a complete control center. Rather, it has been designed for emergency use by supervisory personnel. Measuring 6 ft. wide by 6 ft. 9 in. high, it is located between the main instrument panels for the Fluid unit. Conventional instruments covering the regenerator are to the left, those for the reactor to the right.

Although Esso has been experimenting with graphic type panels since 1940, including their earlier work on the time cycle controllers for hydroforming and for butene dehydrogenation, their approach has been on the conservative side. They are vitally interested in the newest developments, but believe some of the arguments advanced in favor of the more extreme graphic panel designs can be refuted.

Space-saving, for example, is not necessarily obtainable only through use of graphic panels with its miniature instruments. Esso says an ordinary panel with standard size instruments mounted three-high will effect the same economy in space as a graphic when compared with a conventional board with standard instruments mounted two-high. In answer to the question: Wouldn't three-high instruments present a difficulty to the operator keeping his eyes on all dials? Esso counters with: How about the spread of the various dials on a graphic, from almost to the ceiling to well down near the floor level?

The advantage of a graphic for training purposes is a yes-and-no argument. In an established plant, where new units are familiar to operating personnel, training is relatively simple. In a plant like Rock Island, where personnel know very little about the many new process units being installed, training by means of a graphic panel is definitely an advantage.

Used on New Houdriflow Unit

One of the latest installations of graphic panels is on the new Houdriflow unit at Sun Oil's Toledo refinery. Scheduled to go on stream by the end of March, this board incorporates a number of ideas developed by Sun Oil and Houdry Process Corp. engineers. It was built by Panellit, Inc. In general it follows the basic pattern of previously described UOP-Panellit designs. Moore Products Co. Nullmatic M/P stations on the panel provide the remote control point setting, and Nullmatic controllers on the back of the panel or in the field provide the actual control. Foxboro "d/p Cell" blind transmitters are in the field locations, and have all been housed in steam-heated metal cases for protection from the weather.

The Houdriflow unit actually comprises four identical reactor-regen-

erator vessels. Consequently the instrument board consists of a set of four standard 4 x 6 ft. panels, one for each of the four sections of the entire Houdriflow unit.

A Sun-designed temperature indicator has been utilized at four critical locations on each panel—one on the reactor, two on the regenerator, and one in the feed leg to the reactor from the upper hopper and disengaging device. The indicator has a scale reading from 500 to 1500° F. to cover catalyst temperatures. However, it has a very wide range from 900 to 1100° F. so that the temperature can be read fairly accurately to within 5° F. This is accomplished by an eccentric cam arrangement.

The complete panel of the four sections saved 50% in space requirements over conventional type instrumentation, Sun said, and total installation time was only seven hours.

Sinclair to Start Experimentation

Sinclair Refining Co. is well satisfied with the possibilities of utilizing graphic instrumentation. A small, experimental panel of their own design is soon to be put into operation at the Sinclair, Wyo., refinery. C. A. Williams, Sinclair's instrument engineer, told PETROLEUM PROCESSING:

"A refiner cannot afford to consider graphic panels as novelties. The fact that all processing units of at least two existing small refineries are now being operated from a single graphic panel where, otherwise, a number of conventional boards would have been required indicates a saving in operating expense. Such a saving could appear especially attractive in any small compact plant. The apparent advantages of a graphic panel over the conventional boards are the saving in space, lower overall costs, and greater operating convenience. These savings should become more apparent as instrument designs develop and a better understanding of the panel becomes general.

"A small graphic panel will be put into operation soon at our Sinclair, Wyo., plant. The panel is our own design and is essentially experimental. Its purpose will be to develop ideas on the requirements and methods to be used in any future installations.

"We consider the term graphic panel as applying to a panel board flow diagram of the process with flows, pressures, levels, and possibly temperatures being indicated and controlled from instruments mounted at their respective locations in the flow diagram. With the board properly laid out, the operator should have the entire operation of the unit under observation from any point in front of the board. Ideas involving consoles, or table top controls, do not enter into such designs as they tend to restrict the utility of the board by limiting its use solely to the boardman.

"The saving in cost and the space occupied by the graphic panel is governed to a large extent by the number of records considered necessary, and the method of recording. There is promise of a circular chart, multipoint-multicolor-pneumatic recorder being placed on the market soon, and another manufacturer is introducing a graphic controller with a small, built-in, strip chart recorder. These two items should be of considerable help in eliminating most of the problems of recording. Recorders, in general, are auxiliary to the graphic panel and should be available for observation at end of the panel or adjacent to it. The conversion of electronic potentiometer controller readings for pneumatic indication on the graphic panel appears to be an unnecessary refinement, provided the electronic can be mounted at the end or bottom of the board.

"If one wishes to reset the control point of one graphic instrument from the air output of another, he will find that suitable equipment involving flexibility is still wanting.

"We are well aware of the influence graphic panels are having on instrument design, and their probable effects on control methods. The experience we have had so far with graphic instruments has been good. As yet, we have no experience to offer on control methods such as flow installations where force balance instruments are used to measure and transmit, and the control mechanism is mounted on the valve rather than at the board.

"We do believe that graphic panels hold considerable promise for future improvement in instrumentation."

Shell Is Using Small Graphics

Shell Oil Co. has watched the graphic panel development since its inception and has used such panels where they appeared to be the best answer to a control board problem. A Shell spokesman explained to PETROLEUM PROCESSING that their minds are completely open on the subject, but they have not been able to fit either graphic or console type panels into recent construction projects.

The company has a few small graphic panels in operation at pres-

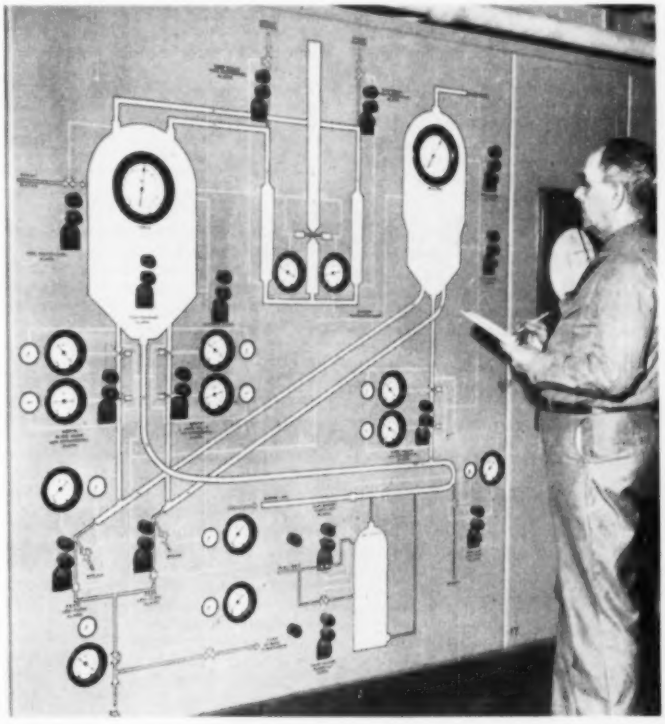


Photo courtesy of Esso Standard Oil Co.

Fig. 6—A simplified graphic type panel designed and installed by Esso Standard Oil Co. at the Bayway refinery on a huge Fluid catalytic cracker

ent, some of which are relatively old. All of them have given satisfactory service; however, most are on small systems involving from three to ten instruments. One instance of a recent larger installation is at Shell's Montreal refinery where a 7000 b/d solutizer treater will use a graphic panel. In this application, nine remote control stations will be used in conjunction with approximately 15 indicators, most of which are connected to fixed-control-point controllers located on process equipment.

Believed First in Canada

This panel, designed by Shell's Montreal refinery engineers, was built by Peacock Brothers, Ltd., of Montreal. It is believed to be the first graphic type panel installed in Canada.

A number of other major oil companies not shown in the list in Table I are also studying graphic panel developments. They include Socony-Vacuum Oil Co., The Texas Co., and Atlantic Refining Co.

Socony-Vacuum is at present conducting a detailed cost and economic comparison study as an engineering department project. Like Esso, they are maintaining a conservative attitude toward the graphic panel. They point out that some of the advantages attributed to the graphic could very well be incorporated into conventional systems. For example, cost savings on instruments in the field, such as blind transmitters, actually have nothing to do with the graphic panel installation, since blind transmitters can be employed with a conventional system.

Engineers with Socony, Atlantic, Sohio, Sinclair and Esso indicated interest in a new remote setting control station which includes a 4-in. size strip chart recorder. To be tradenamed the "Transet" recorder, this new device is being introduced by Taylor Instrument Cos., who have been showing a hand-made model around the country during the past several weeks

Details of the latest design, (see Fig. 7) as released to PETROLEUM PROCESSING two weeks ago, are as follows:

"It is a recording-receiving instrument specifically designed for graphic or conventional panels. It will fit into a panel opening $3\frac{7}{8}$ x $4\frac{1}{2}$ in. The front or face with its flange measures $4\frac{1}{2}$ x 5 in. When the plastic door is opened, automatic and manual adjustments can be made. The left top lever permits instant checking of valve position. The right top lever permits changes from automatic to manual control. Two screws above this lever are the micrometer zero adjustments for set-pointer and pen.

"The scale at the right carries the range of the receiving instrument,

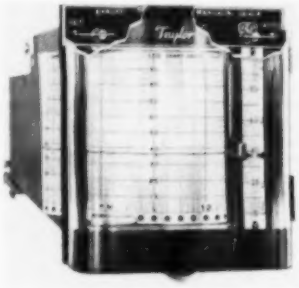


Photo courtesy Taylor Instrument Co.

Fig. 7—Latest design of Taylor's new Transet recorder with a 3-in. wide strip chart

which means that when the transmitter is changed, it is only necessary to change this scale to agree. It is marked to show 3 to 15 psig., helpful for noting valve position and for calibrating.

"The instrument has a 30-day strip chart with vertical time lines. It is about 3 in. wide and has 100-line graduations, evenly divided. It is also available as a 0 to 10 square root chart. The chart discharges from the side at a 1-in./hr. rate, and it can be torn off at the side or the front. Since it moves from right to left, it produces a record similar to one which would be plotted by a process engineer. The chart and motor drive is designed to pull out like a camera."

Universal Oil Products Co. is very well satisfied with the possibilities of this new instrument, which represents the answer to one type of instrument they requested from manufacturers after watching their installation at Rock Island in operation since last September. UOP plans to use 50 Transets in the panel being installed on a Fluid unit at the Indiana Farm Bureau refinery in Evansville. In explanation of their reasoning, David M. Boyd, Jr., UOP instrument engineer, told PETROLEUM PROCESSING:

"The operating experience that we have had so far seems to indicate that the operators would like to save some records, but for an entirely different reason than we expected. They want them for a record of what changes they (the operators) made over the past three hours. Operators are changing various controlled conditions so as to control some uncontrolled condition, such as boiling range or end point of product, or the temperature of the catalytic unit regenerator."

Another device UOP asked manufacturers to develop is a controller mounted directly on a control valve for controlling flow.

"It is desired to have this controller take its feed back directly from the motion of the valve stem," Mr. Boyd said, "and thus it will have a positioning as well as a controlling action. To date we do not know definitely of any company who is building this item, although we have approached several. This item is very desirable for the control of fast processes where having the controller in the field is an advantage over having it in the control room."

The miniature remote control point setting stations developed by Moore Products have been widely used on most graphic panel installations. They have played a major role in the development of both the UOP-Panellit design and the Sohio-Lummus design panels. Little information has been published concerning these Nullmatic M/P stations since they were first placed on the market. (See PETROLEUM PROCESSING, January, 1949, p. 94, "What's New!" Item No. 16).

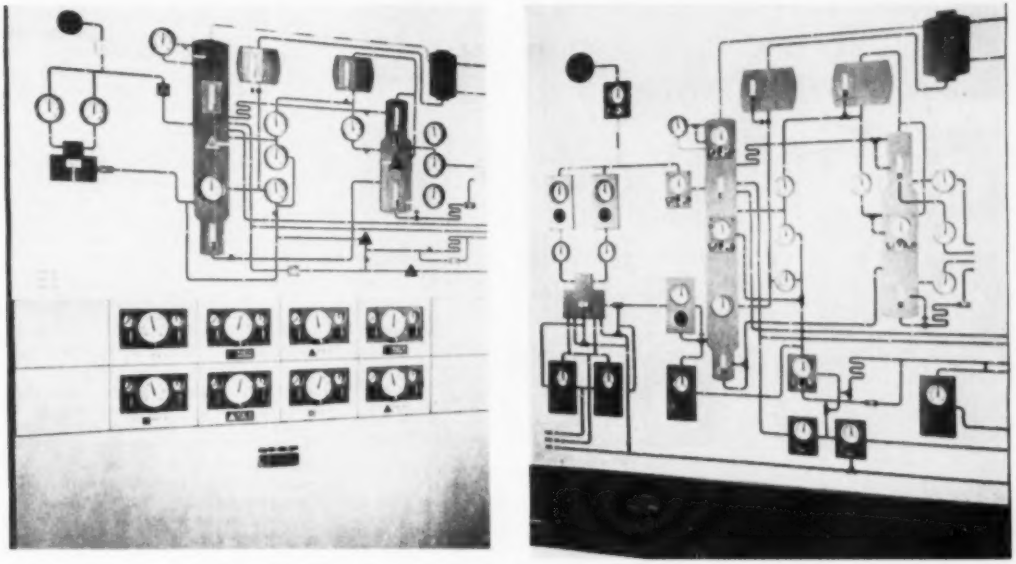
Essentially, the M/P station receives the primary element's signal from the transmitter and in turn regulates the action of a pneumatic controller, which may be either field- or board-mounted. If field-mounted, four instrument air lines are required. If the controller is located behind the panel, only two air lines pass to the field—one coming from the transmitter, the other going to the valve motor.

UOP is strongly in favor of field mounting the controllers for flow and

Acknowledgment

PETROLEUM PROCESSING is indebted to the following companies who made available the information on which this article has been based:

Atlantic Refining Co.
Automatic Temperature Controls, Inc.
Brown Instrument Co.
Cities Service Oil Co.
Esso Standard Oil Co.
The Foxboro Co.
General Electric Co.
Gulf Oil Corp.
Houdry Process Corp.
The Lummus Co.
Moore Products Co.
M. W. Kellogg Co.
Panellit, Inc.
Pure Oil Co.
Rock Island Refining Corp.
Shell Oil Co.
Sinclair Refining Co.
Socony-Vacuum Oil Co. Inc.
Standard Oil Co. (Calif.)
Standard Oil Co. (Ohio)
Sun Oil Co.
Taylor Instrument Cos.
The Texas Co.
Universal Oil Products Co.



Photos courtesy of Brown Instrument Co.

Fig. 8—Two new graphic panel designs developed by Brown. At the left is the so-called "Color-Grafic". At the right is a straight graphic type

liquid pressure; and especially for flow, where speed of response is very important. Sohio was originally in favor of board mounting all controllers, because (1) cost is lower—two vs. four air lines, (2) board mounted controllers are easier to adjust and maintain than those scattered all over the unit, and (3) they had had no experience or evidence to indicate any great improvement in control would result from field mounting.

This thinking has been revised somewhat since Sohio engineers have observed the Rock Island installation of a UOP-Panellit panel. They now feel that field mounting not only improves control on many flow and liquid pressure applications, but in some cases valve operation was made very stable without the use of a positioner.

New Panel Designs Use Color

The parade of new devices and new panel designs has, of course, not stopped. Brown Instrument Co. a month ago announced that two new panel designs would soon become available. (See PETROLEUM PROCESSING, March, 1950, p. 297, "What's New!" Item No. 1).

Basically, Brown feels there is a need for two types of panels, and accordingly is introducing a so-called straight "Grafic" and also a "Color-Grafic" panel. The design of both panels, developed in cooperation with a large refinery contracting engineering firm and the Henry Dreyfuss organization of industrial designers, involves an efficient use of color, arrangement, and special symbols.

In general, it follows the concepts of other graphic panels and utilizes several newly developed miniature gages, controllers, and the like, made up by standard Brown parts. Fig. 8 shows both types of panels. In the standard panel, all indicators and remote control point setting instruments are incorporated within the process diagram. In the Color-Grafic, the remote set instruments have been arranged below the diagram, permitting a more compact chart to be used.

Large space economies can be realized with both models. As an example, an installation using conventional instruments required a panel 45 ft. long when the instruments were mounted two-high on 24-in. panels. A Color-Grafic panel for the same application reduced the overall length to 22 ft. 8 in. Included in this length were two 3 ft. 8 in. wing extensions to accommodate potentiometer controllers, recorders, and service gages. This length can be further reduced to 19 ft. if some of the recorders are mounted directly below the main panel, eliminating one of the wings. Thus a total saving of 26 ft. over the conventional panel can be obtained, or over 57%.

A similar comparison with conventional panel and straight graphic indicated the overall length could be reduced to 24 ft. 4 in.

One of the main features in the Color-Grafic panel is the use of a new instrument component, called the Compact-Indicating-Controller, or C-I-C unit. Occupying a panel space of 8⅝ x 11¾ in., there are eight such units arranged in two banks below the flow diagram in the picture at the left in Fig. 8. This device uses the same pneumatic control element that has been used for a number of years in the company's standard recording controllers. It receives signals from a blind transmitter at the process and in turn regulates the diaphragm motor valve at the process.

A device designed and used in the straight panel is the so-called Tel-o-Set unit. This instrument, also built from standard parts, performs approximately the same function as the C-I-C, but requires a blind controller between it and the valve motor. The controller can be mounted behind the panel or in the field. The Tel-o-Set occupies a panel space of 5 x 6½ in.

Flow Chart Can be Small

When the C-I-C units are used, as in the Color-Grafic, the flow chart can be made to a relatively small scale. Gages shown directly in the processing unit symbols and flow lines indicate level and other variables not controlled from the panel. Additional gages can be added to supply indications of variables also shown on the C-I-C units. Air lines to these gages are tapped into the transmitted lines going to the C-I-C units.

Since the pictorial flow chart need support no appreciable weight, it can be fabricated of light materials such as thin metal or plywood. Proc-

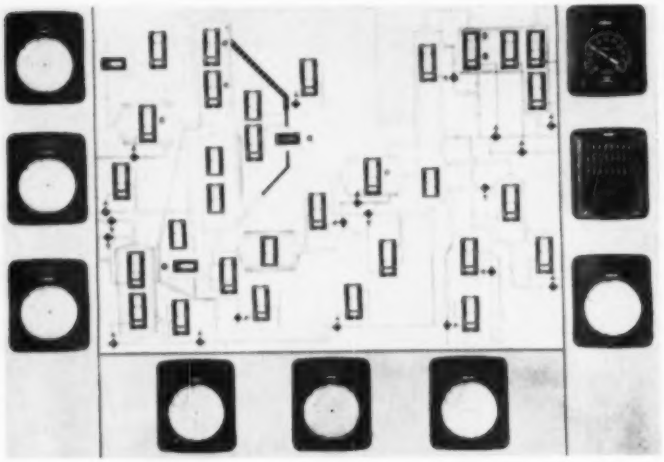


Photo courtesy of The Foxboro Co.

Fig. 9—A model graphic panel designed under development by Foxboro

ess units and flow lines can be painted directly on the panel in a line of standard colors so as to facilitate making changes in process flow as needed.

The identification of a C-I-C unit with respect to its point of application on the flow diagram is accomplished by means of color. Identification of the variable under control is effected by a symbol. For example, a circle can indicate flow, a triangle temperature, and a square pressure. The color of the symbol identifies the point of application.

The straight type panel is limited somewhat in flexibility. Since the flow diagram must support the weight of all Tel-o-Set units, any C-I-C units that are used, and other gages, it must be fabricated of fairly heavy sheet steel. Process unit symbols and flow lines can be painted on or made of some material which can be fastened to the base panel. Obviously, any changes must then necessitate additional work such as cutting new holes, covering old ones, etc.

Blind Transmitter Is Useful

Another instrument being widely used in graphic panel instrumentation systems is a blind transmitter, Foxboro Co.'s "d/p cell." It is pneumatic force balance device for measuring and transmitting flow and liquid level by converting differential pressure into proportional air pressure. First introduced almost two years ago (see PETROLEUM PROCESSING, June, 1948, p. 604, "What's New!" Item No. 13), this mercury-less instrument greatly simplified transmission problems.

Another Foxboro development, as yet not formally announced, is a 6-point, multi-record receiver-recorder for graphic panel use. A full description is not yet available, but V. V. Tivy, the company's sales manager for refining industries, told Petroleum Processing:

"Its general design is similar to our electronic, multi-record instrument except that the "Dynalog" measuring circuit is replaced with a single receiver hydron. The electric 6-point switch is replaced with a pneumatic switch so that the six incoming signals are connected consecutively to the hydron.

"This instrument is a very recent development. There are only four in the field, all at Wood River Oil & Refining Co.; however, many people have seen the first test installation made at Rock Island. It is also being used in Sohio's Lima, Ohio, Lube oil unit."

Foxboro also has developed a number of graphic panel ideas, similar in general concept to other present designs. The company, however, has not announced any plans yet for the actual commercial development of such panels, nor of equipment to go on them except for those components described above.

One of the panel ideas is illustrated in Fig. 9, a graphic board for a catalytic cracking unit. This unit might also be built, the company states, in a console model without the flow diagram. Again a miniature remote control point setting device is suggested. In this case, it is a vertical scale type, which would occupy a panel space 3 x 6½ in., small enough to fit into a process flow diagram on the panel.

Graphic type instrument panels have of course not yet reached their final stage of development. Refiners agree they can and will be further improved, and several have cited specific problems which must be solved.

1. In general, the choice of field or board mounting of controllers need not be solved immediately. It remains a matter for decision by the individual refinery operator.

2. The volume and extent of records desired by the operator will determine the amount of development devoted to new miniature recorders.

3. Much can be done to improve readability of the dials and recorders so as to permit rapid, visual observation of overall process conditions and quick detection of variables which may go "of the beam." Kevin N. Thompson, Supervisor, Power Utilities Section, Genl. Engrg. Div., Mfg. Dept., Standard Oil Co. (Ohio), has an interesting view on this. He said:

"It is suggested that indicating controllers be developed having an 'open window' type of scale, showing not over three significant figures; dials to be adjusted by the control point setting to a center hairline, and the indicator to swing either side of the center as required to show the measured variable.

"It is suggested that recorders be developed using strip charts rather than round charts; these charts to show the past three to four hours only, and to re-roll the balance of the chart. It will be necessary to develop planimeters for use with these charts."

A planimeter normally is used on flow charts. It is a mechanical integrating device which will obtain the average value on a square root chart, thus being used to interpret trends.

Visualizes Integrated Control

4. Transmission systems with a high response speed are a must if graphic panel arrangements are to benefit overall refinery control. Mr. Thompson points out:

"Possibly one of the biggest advantages of co-ordinated instrumentation will come when the larger refineries are able to utilize integrated control between process units to reduce the necessity for intermediate surge or other tankage.

"A concept of a refinery which emphasizes this point might be a bulge in a pipeline, wherein the products leave the refinery continuously at the same rate as the stocks enter. There are many reasons why this is not practical.

"However, by the use of a simple, over all flow control station, working from tank levels, and utilizing surge to maximum capacity; it should be possible to cut down the tankage requirements between units very appreciably. This concept immediately develops the need for transmission systems of highest reliability having much less lag than those now in existence."

API Refining Division Committees Report on Their 1949 Activities

An important and basic function of the Refining Division of the American Petroleum Institute is to organize and administer a series of technical committees. The committee work covers a wide variety of technical and personnel projects, and the practical value to the industry of the data worked up by the committees is very considerable.

The work and reports of these committees too often have not been brought as widely as they should be to the attention of the industry. Many refiners are not aware of the practical help they can obtain from the reports for their own plant operations.

This month, with the cooperation of W. T. Gunn, director of the Refining Division, his staff, and the committee chairmen, *Petroleum Processing* presents brief summaries of the division's technical committees—their major functions and current activities. We regret that space prevents us from also publishing the names of the active members of the various committees and subcommittees—for it is only because of their efforts that there are any activities on which to report.

Committee on Analytical Research

Chairman—E. L. Baldeschwieler
Standard Oil Development Co.

THE Committee on Analytical Research was organized in 1946 to continue the work carried out during the war by the Analytical Subcommittee of the Technical Advisory Committee of the Petroleum Industry War Council.

The function of this committee is to develop chemical and physical analytical procedures for use by the petroleum industry. The work programs originate from requests by other API committees or may be chosen by a majority agreement of the committee members, and are carried out by a number of subcommittees. The Subcommittees on Emission Spectroscopy, Analysis of Oxygenated Compounds, and Waste Disposal Analytical Methods were very active last year. Cooperative work was carried out in an effort to develop an electrode dipping technique for the emission spectroscopic determination of certain elements present in additive lubricating oil blends and a satisfactory procedure was developed. Synthetic mixtures of hydrocarbons with various types of oxygenated compounds were analyzed cooperatively for total oxygen content, using procedures for the determination of oxygen types, total oxygen by difference from carbon and hydrogen determinations, and direct oxygen determination by the Unterzaucher method. The Subcommittee on Waste Disposal Analytical Methods is testing cooperatively three suggested procedures for the determination of total mineral oil in refinery effluents.

Three additional subcommittees have been organized and are ready to function. The subjects covered include the determination of nitrogen, trace elements analysis, and x-ray diffraction data.

A symposium on Rapid Methods of Analysis was sponsored by the committee at the 1949 API Midyear Meeting, the agenda being prepared on the basis of suggestions received from Committee members.

Another activity of the committee has been the editing and releasing of the various analytical procedures developed during the War Emergency, and at that time on the restricted list. They are now being published and can be purchased from the API.

Automotive Research Committee

Chairman—D. P. Barnard
Standard Oil Co. (Ind.)

PURPOSE of the Automotive Research Committee is to promote the most efficient use of automotive fuels and lubricants through the study of those characteristics of atuomotive equipment which affect the utilization of petroleum products. The committee sponsors investigations and other activities as may be required to achieve these ends. The committee also sponsors group sessions on automotive fuels and lubricants, and acts as an advisory council to the Board of Directors of the Coordinating Research Council. Its meetings serve as forums for the discussion of industry problems concerning the relation of fuels and lubricants to the performance of automotive equipment.

The committee is composed of responsible technical representatives of petroleum companies, and serves primarily as an advisory and liaison group between API and the Coordinating Research Council. In this capacity, it functions also as adviser to CRC on matters of general petroleum industry interest.

The Automotive Research Committee has not thus far directly administered any research projects. It has considered and recommended a number of projects which, however, have been referred to other organizations (usually CRC) for execution.

An important project recently completed is that of determining the effect of sulfur content in motor gasolines. Under CRC supervision, some seven fleets totaling 62 vehicles were operated under comparative conditions with gasolines of varying sulfur content. These tests have been completed and the final report has been prepared and is due to issue in the very near future. Another test still in progress is the full-scale railroad diesel fuel test which is designed to establish the greatest possible availability of diesel fuels for railway service. These tests are now well under way and are scheduled for completion during 1950. A fundamental study of diesel fuel combustion currently being conducted at the Bureau of Mines is another CRC project recommended by the Automotive Research Committee.

The Automotive Research Committee has also recommended a new CRC project for the study of certain fundamentals of detonation and combustion in internal combustion engines. This work is to be carried out at Battelle Memorial Institute and represents a cooperative effort by the U. S. Navy Bureau of Aeronautics, the American Petroleum Institute, the Aircraft Industries Association, and the Automotive Industry. It is hoped that actual experimental work can begin in 1950. This project is initially planned for a period of 3 years.

In addition to these research proj-

ects, the Automotive Research Committee also sponsors the petroleum industry's cooperation in the Bureau of Mines semi-annual motor gasoline surveys and annual aviation and diesel fuel surveys.

Committee on Petroleum Products

Chairman—H. W. Field
Atlantic Refining Co.

THE Committee on Petroleum Products has responsibility for the formulation of all recommendations on matters pertaining to specifications, methods of test and methods of measurement for petroleum products, and considers all suggestions for recommendations in this field whether initiated in the committee or in other groups in the American Petroleum Institute.

It also serves as an advisory committee to other API committees and, when properly authorized, directs API sponsored investigations and development on matters appropriate to the field of petroleum products.

Through its Subcommittee on Viscosity Standards, it distributes standardized oil samples for viscosimeter calibrations.

During 1949 the main activities of the committee were carried out by its various working subcommittees. These activities are highlighted in the following brief summary.

The Glossary Subcommittee is completing a glossary of petroleum refining terms, giving definitions not available in desk type dictionaries, and also including shorthand symbols wherever practicable.

The Technical Oil Mission Study Group, working with its 18 individual film study groups located throughout the industry units, is continuing to process microfilm reels, and prepare abstracts and translations. Arrangements have been made through the Consultants Bureau in New York for continuing to add to these translations and to make selected articles available at a relatively low cost.

The Subcommittee on Viscosity at High Rates of Shear is investigating the relationship of the viscosities of oils of various compositions when determined by conventional viscosimeters as compared to determinations made at high rates of shear, the latter being conditions under which most oils are actually used. The data obtained indicate that this work will probably be of considerable value in that it may change some of our concepts on oil behavior in actual service. The final reports on this work were presented to the Committee in a symposium at the last annual meeting in November, 1949. Prompt publication of the papers is anticipated, probably thru A.S.T.M.

The Viscosity Project Subcommittee, acting as an advisory committee to the Franklin Institute of Philadelphia, has been studying the possibilities of measurement of oil viscosity by the use of a torsionally vibrating crystal, a fundamental approach not heretofore attempted. Thus far measurements have been made at 100° F. on seven secondary standard oils, the test crystals having been furnished to the project by the Bell Telephone Laboratories.

The Subcommittee on Vapor Temperature Data is functioning in an advisory capacity to an API sponsored research fellowship at Northwestern Technological Institute. The purpose of this fellowship is the preparation of much needed vapor pressure-temperature correlations of petroleum fractions.

The Subcommittee on Octane Precision is functioning in an advisory capacity to a project which was lodged at the Bureau of Standards to develop, if possible, necessary modifications to the equipment and operating conditions of the ASTM motor and research octane methods to bring about an improvement in rating precision, particularly with regard to the very important but little understood effect of altitude. A report on the results of the work is in preparation.

The Subcommittee on Oil Measurement Calculations is functioning in an advisory capacity to a joint project of the British Institute of Petroleum and the ASTM for the preparation of tables for calculating oil volumes from the temperature of measurement to a standard temperature, converting units of volume to units of weight and vice versa, and for making conversions from one system of measurement to another. Preparation of these tables is underway.

All projects brought to the committee's attention for possible study and development receive very careful screening. The normal procedure has been to appoint a small study group expert on the particular subject matter to review the proposal and report to the committee the pros and cons of the proposal with recommendation.

Two such study groups have recently been active.

In the first instance, the API was approached by Committee Z-11 of the American Standards Association proposing that API support the secretariat of the International Standards organization project 28 on Petroleum Products. The Subcommittee recommended and the Committee on Petroleum Products agreed to turn down this proposal.

In the second instance, the API was requested to support the ASME gas properties research project on research and computational work on thermal dynamics and physical properties of gases and mixtures of gases. The study committee has investigated this project and reported that the ASME project has not been crystallized to the point where it is a fit subject for API activity and has recommended no action by the Committee on Petroleum Products at the present time.

These recent examples of negative action on the part of the Committee on Petroleum Products are stated to illustrate that this committee does not accept commitments without thorough investigation as to the importance of the work to the industry.

Committee on Disposal of Refinery Wastes

Chairman—L. C. Burroughs
Shell Oil Co.

THE Committee on Disposal of Refinery Wastes collects and makes available in convenient form the technical information which will assist refiners in preventing the escape of offensive or harmful materials. When pertinent information is not available in the literature, the committee plans, sponsors and supervises industry-financed research projects to develop it.

As one of its functions the committee compiles a Manual on Disposal of Refinery Wastes, published in three sections and available from API.

Section I—Waste Water Containing Oil deals with oily waste waters and sets forth information on pollution of surface waters, design of waste water separators, filtration of waste water, emulsions, sampling and testing, measurement of water flow, and handling of ballast water that is often pumped from tankers and barges into refinery waste disposal facilities. The Fourth Edition of this section became available in August 1949.

Section II—Waste Gases and Dusts sets forth information on the classification of gaseous wastes and aerosols, properties of gases and aerosols, sampling and testing, design of gas disposal systems, and diposal of dust and ash. The Third Edition has been available since November 1947. Recent developments in handling gaseous wastes make the Committee keenly aware of the desirability of enlarging this section to include the latest available information.

Section III—Waste Water Containing Solutes is not now available. The First Edition of this section, published in 1935, is now under revision.

Two research projects are in progress at the present time:

1—Studies of the behavior of oil-water mixtures in gravity-type separators, to obtain engineering data for use in designing separators. This project is being conducted in the Hydraulics Laboratory of Wisconsin Research Institute, located at the University of Wisconsin, under the direction of the Subcommittee on Oil-Water Separation.

2—Development of laboratory techniques for the determination of toxicity of various substances to plankton forms occurring in fresh and brackish waters. This project is being conducted at the Academy of Natural Sciences in Philadelphia, under the direction of the Biological Subcommittee.

Committee on Refinery Equipment

Chairman—B. H. Barnes
Gulf Oil Corp.

THE Committee on Refinery Equipment has the responsibility of fostering the API program of standardization of refinery equipment and of formulating recommendations on engineering practice in the promotion of safety for the plant, worker, and general public.

As a matter of policy, the committee does not organize standardization projects in a given field except when no other authoritative agency is willing or able to undertake the particular problem, or when such authoritative agency is unable to provide needed standards acceptable to the petroleum industry. When developing standards suitable for the petroleum industry, the committee cooperates with established agencies by naming representatives to serve on committees and working groups.

When there is no agency working in a given field, the committee organizes needed projects. When standardization is involved, the consultation and cooperation of the manufacturers of the equipment in question are enlisted.

At present the committee has nine active projects, each one of which is carried out by appropriate subcommittees. These projects are:

Study of the Design and Construction of Pressure-Relieving Systems—This study is being conducted by the Subcommittee on Pressure-Relieving Systems, E. O. Mattocks, chairman, with the assistance of a Manufacturers' Subcommittee on Safety and Relief Valves, L. P. Stillman, chairman. Early phases of the study involved the establishment, in 1946, of a research project at the University of Michigan to gather and summarize the methods used by engineers of the petroleum industry in designing and constructing pressure-relieving systems. The study resulted in the publication of Engineering Bulletin No. 31, "The Design and Construction of Pressure-Relieving Systems," available at a price of $3 per copy from the University.

Study of the Design and Construction of Unfired Pressure Vessels—This project is under the charge of the Subcommittee on Unfired Pressure Vessels, N. J. Rees, chairman. The subcommittee acts as an advisory forum to the API members of the API-ASME Committee on Unfired Pressure Vessels.

Study of Inspection Procedures for Petroleum Refineries—This project is being conducted by the Subcommittee of Refinery Inspection Supervisors which is engaged in writing a manual of "Recommended Practices for Refinery Inspections."

Efforts to date have resulted in the publication of two parts of the projected manual of Recommended Practices for Refinery Inspections: Part I on Process Equipment ($3.00 per copy), Part II on Pressure-Relieving Systems ($0.75 per copy). Part III on Fire-Protection Equipment has been completed and will be available soon ($1.00 per copy). Part IV on Tanks and Spheroids, Part V on Instruments, and Part VI on Electrical Equipment are being drafted.

Standardization of Refinery Valves—This project is under the Subcommittee on Valves, Homer Reed, Chairman, and the Manufacturers' Subcommittee on Refinery Valves, W. P. Kliment, Chairman. The project resulted in the publication of API Standard 600A on Flanged Steel Outside-Screw-and-Yoke Wedge Gate Valves in 1938 and API Standard 600B on Flanged Steel Plug Valves in 1940. By 1949 these two standards were judged obsolete and were replaced by API Tentative Standard 600 on Flanged and Welding-End Steel Wedge-Gate and Plug Valves for Refinery Valves.

Study of Corrosion of Refinery Equipment—This project is under the Subcommittee on Corrosion, M. S. Northup, Chairman. The Subcommittee acts as a forum for the discussion of corrosion problems and sponsors technical symposia on the subject.

Study of Tank Accessories and Cleanouts—This project is under the Subcommittee on Tank Accessories and Cleanouts, E. E. Kerns, Chairman. The studies of the Subcommittee have convinced the members of the desirability of standardizing the design of tank cleanout openings, as a result of which a Manufacturers' Subcommittee on Tank Cleanouts is being organized.

Study of Mechanical Equipment—This project is under the Subcommittee on Mechanical Equipment, E. F. Voss, Chairman. The Subcommittee is surveying the field of pumps, compressors, and like equipment and is assessing the opinion of the petroleum industry on the desirability of developing standards in the field.

Study of Electrical Equipment—This project is under the Subcommittee on Electrical Equipment, L. M. Goldsmith, Chairman. The Subcommittee is engaged in drafting a construction code for electrical equipment. The Subcommittee plans to draft a Recommended Practice for the Inspection of Electrical Equipment which will be referred to the Subcommittee of Refinery Inspection Supervisors.

Study of Refinery Instrumentation—This project is under the Subcommittee on Instruments, M. H. White, Chairman, and is engaged in drafting a Recommended Practice for the Inspection of Control Instruments, which will be referred also to the Subcommittee of Refinery Inspection Supervisors.

In addition to the active projects given above, the Committee on Refinery Equipment has under consideration the organization of a project to study the construction of large, low-pressure (0 to 15 psi.) storage tanks and spheroids.

Committee on Training

Chairman—T. M. Rushing
The Texas Co.

THE Committee on Training in Refining assembles and makes available to the refining industry and others significant information concerning existing practices, techniques, problems and trends in the field of employe training. It does this through the publication of the results of pertinent studies and surveys; papers describing specific training programs, techniques and procedures, and the sources and nature of training aids and services available to the industry; and reports of industry-wide training problems and training needs.

The Committee sponsors forums for the discussion of training subjects. It also sponsors practical research in the field of employe training, and the development of certain basic training materials needed by the industry.

It serves as a liaison agent in regard to employe training in refining between individual segments of the refining industry, between the refining industry and its suppliers, and between the industry and educational agencies.

During the years 1948 and 1949, the committee sponsored three research projects, as follows:

1. A survey of organized training practices employed in the refineries of the United States. This survey was conducted by the Industrial and Business Training Bureau of the Division of Extension of the University of Texas. Its purpose was to determine the status of organized training in the refineries of the United States. The survey, which covered more than 90% of the total operating capacity of refineries in the United States, resulted in the publication of a substantial report entitled "Organized Training Practices Employed in the Refineries of the United States."

2. A study of films suitable for use in refinery training programs. This

study was conducted under the auspices of the Committee on Training by a firm of consultants. It resulted in the publication of "A Catalogue of Films Applicable to Petroleum Refining Industry."

3. A study was made of the training services which are available to petroleum refineries from public agencies. This study was conducted jointly by the Gulf Coast Sub-Committee of the Committee on Training, and the Division of Extension of the University of Texas. It resulted in publishing and distributing a "Directory of Training Services Available from Public Agencies for Petroleum Refineries."

Plant Maintenance Is Topic For API Refiners' Meeting

VARIED technical and personnel topics are programmed for the Mid-Year Meeting of the API Refining Division, in Cleveland, May 1-4. Important committee reports also will be presented. API Certificates of Appreciation will be presented at the Open Dinner, May 3, at which Chester F. Smith, Standard Oil Co. (N. J.) API Vice President for Refining, will preside.

The degree of interest manifest in the session on Refinery Maintenance at the 1949 meeting prompted the scheduling of another session on the same subject, May 3. A group session on Training of Plant Supervisors will be held May 2, M. W. Boyer, vice president in charge of manufacturing, Esso Standard Oil Co., presiding.

Both sessions on May 4 will be devoted to Motor Fuels. One paper to be presented by technologists of Universal Oil Products Co., will discuss the properties of "Platformate", the motor fuel product of the new Platforming Process for upgrading straight-run gasoline and naphtha. Another paper will present the first data to be made public from the Coordinating Research Council's study of the effect of sulfur in motor fuel on engine operation. In this study some seven fleets totaling 62 vehicles were operated under comparative conditions of gasolines of varying sulfur content. These tests have been completed and the final report has been prepared and is to be issued in the near future. D. P. Barnard, Standard Oil Co. (Ind.), and T. B. Rendel, Shell Oil Co., will preside at the Motor Fuel sessions.

New methods of analytical research for petroleum products are to be presented at a Symposium on this subject May 1, sponsored by the API Committee on Analytical Research, of which E. L. Baldeschwieler, Standard Oil Development Co., is chairman.

Program for API Refining Division Meeting

MONDAY, MAY 1

Symposium on Analytical Research

(Sponsored by the Committee on Analytical Research)

Rapid X-ray Examination of High-Sulfur Cracked Distillates, Harold K. Hughes and John Wilczewski, The Standard Oil Co. (Ohio), Cleveland.

Analysis of High-Sulfur Cracked Distillate, J. F. Wilson, Union Oil Co. of California, Wilmington, Calif.

Mass Spectrometric Determination of Traces of Sulfur Compounds in Synthesis Gas, J. H. Shively and F. Philgreen, The Texas Co., Beacon, N. Y.

The Copper-Strip Test—A Study of Current Method of Interpretation and Examination of Proposed New Procedure, S. W. H. Matthews and P. G. Parsons, Anglo-Iranian Oil Co., Ltd., Research Station, Sunbury-on-Thames, Middlesex, England.

Determination of n-Paraffins by Urea Adduct Formation, W. J. Zimmerschied, W. S. Hegley, and A. P. Lien, Standard Oil Co. (Indiana), Whiting, Ind.

Construction and Application of an Automatic Titrimeter, W. S. Young, The Atlantic Refining Co., Philadelphia.

Factors Affecting Precision Viscosity Measurements with the Torsion Crystal, P. E. Rouse, Jr., E. D. Bailey, and Jean A. Minkin, The Franklin Institute, Philadelphia.

TUESDAY, MAY 2

Corrosion

Corrosion of Relief Valves, R. J. Hafsten, Standard Oil Co. (Indiana), Whiting, Ind.

Cathodic Protection of Open-Box Coil-Type Condensers and Coolers, C. R. Draughon, A. B. McNeil, Esso Standard Oil Co., Baton Rouge, La.

Training Supervisors

(Sponsored by the Committee on Training)

Three outstanding papers on Training and Development of Supervisors.

WEDNESDAY, MAY 3

Waste Disposal

Scrubbing Devices for Air-Pollution Control, E. P. Kropp, The Standard Oil Co. (Ohio), Cleveland.

Administration of Public Law No. 845, Carl E. Schwob, Chief, Division of Water-Pollution Control, Federal Security Agency, Public Health Service, Washington.

Operation of API Oil-Water Separator at Trenton Refinery, C. F. Miller, Socony-Vacuum Oil Co., Inc., Trenton, Mich.

Use of Bacteria as Test Organisms in Stream-Pollution Studies, W. B. Hart, The Atlantic Refining Co., Philadelphia.

Refinery Maintenance

Layout and Operation of New Shops — Houston Refinery, Robert Haldane, Shell Oil Co., Houston.

Maintenance Practices in a Small Refinery, John S. Pfarr, Leonard Refineries, Inc., Alma, Mich.

Human Relations in Refinery Maintenance, R. L. Rude, Sun Oil Co., Philadelphia.

Open Dinner Session

Presiding: Chester F. Smith, Vice President for Refining (American Petroleum Institute), Standard Oil Co. (New Jersey), New York.

Presentation of the John Scott Award.

Presentation of API Certificates of Appreciation.

Where Do We Go From Here? Sherman Rogers, Cleveland.

THURSDAY, MAY 4

Motor Fuels

Presiding: D. P. Barnard, Standard Oil Co. (Indiana), Chicago.

A paper on The Constant-Volume Combustion of Diesel Fuels (exact title not yet obtained), R. E. Hurn, U. S. Bureau of Mines, Bartlesville, Okla.

Methods of Estimating Cetane Number, Hobart D. Young, Sinclair Refining Co., Harvey, Ill.

Effect of Sulfur in Motor Gasoline in Engine Operation: A paper based on a CFR report, J. B. Duckworth, Standard Oil Co. (Indiana), R. E. Jeffrey, Shell Oil Co., E. J. Gay, Consulting Engineer.

Motor Fuels: (cont'd.)

Presiding: T. B. Rendel, Shell Oil Co., New York.

Road Effectiveness of Lead as Influenced by Sulfur, Donald H. Pulleybank and W. G. Lovell, Ethyl Corp., Detroit.

Effects of Hydrocarbon Structure on Road Knock Performance of Motor Fuels. T. D. Prickett, M. H. Campbell, and D. A. Knee, E. I. du Pont de Nemours and Co., Wilmington, Del.

Platformate—Properties and Performance, J. S. Bogen and Vladimir Haensel, Universal Oil Products Co., Chicago.

Outlook For Gas Liquids Industry

Economic and Market Factors Weighed for Their Influence on the Long-Term Expansion of Natural Gasoline and Cycle Plant Industry in the Southwest

By D. P. THORNTON, Jr.
Southwestern Editor

THE year 1949 was a "boom" year for the natural gasoline industry. Production of natural gas liquids reached the all-time high of 156,203,475 bbls., 6.5% more than the previous peak year of 1948.

In contrast with crude oil production, where the U. S. total decreased in 1949, the output of natural gas liquids continued its upward trend. The rate of gain has been 20% or more each year since 1945, bringing the total annual output at present to a little more than 8% of domestic crude production. In 1945, output of natural gas liquids was but 6% of domestic crude oil production.

At the end of 1949, liquid capacity of plants installed is estimated at approximately 714,000 b/d. Plants now under construction or authorized will increase this to approximately 762,000 b/d. A number of plants are now under consideration or being designed whose capacities are not available.

In 1949 approximately 48 new natural gasoline and cycle plants were completed in the U. S. while 31 plants underwent extensive revisions and capacity increases. At the start of 1950, 22 plants were under construction, seven authorized, and three undergoing capacity increases. These are exclusive of compressor installations, pressure maintenance projects and facilities for dehydration or desulfurization only.

The short-term outlook for the natural gas liquids industry is not as bright as it was early in 1949. Product prices are down, reflecting current oversupply in relation to demand. The end of the immediate building boom carried over from 1949 is in sight, and it appears likely that 1950 natural gas liquids production may fall below 1949 despite more plant capacity.

The long-term outlook, however, is much brighter, particularly in the Southwest. The combined effect of several factors will work toward a continuing expansion of the industry there, and toward a more generally accepted utilization of natural gas liquids and their products both within and without the petroleum industry. The major factors contributing to this trend toward future expansion include:

1. Growth in the underground reserves of natural gas liquids, which naturally follows from the new additional reserves of natural gas and crude oil which have been uncovered in the past few years.

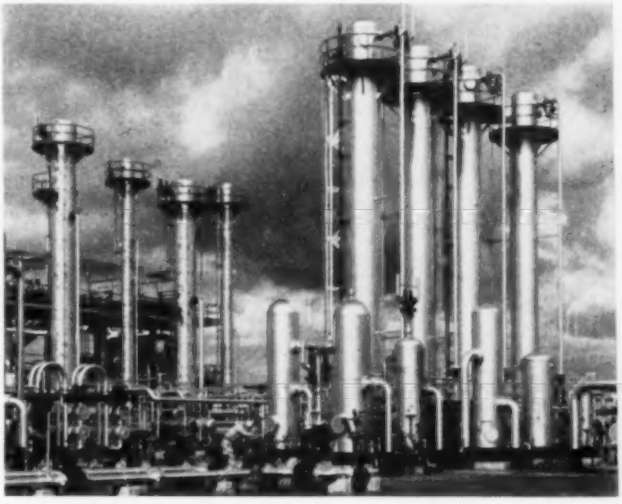
2. The vastly increased expansion of natural gas pipelines and the resulting tapping of large new potential markets for gas. This will greatly increase the volume of natural gas produced in the Southwest, available for processing for extraction of liquids.

3. The increasing insistence of the state regulatory authorities on the conservation of natural gas liquids as well as the gas itself. This will bring about the likelihood of the allocation of the production of natural gas liquids, in relation to demand for liquid hydrocarbons, as crude oil is now located.

The short-term effect here might be to restrict the output of natural gas liquids, particularly in the Southwest. However, over a longer period it should focus greater attention on the potential supply of liquid fuels and other products available through gas liquids, and insure their full use to supplement our crude oil supplies before the industry turns to synthetic fuels.

4. The increasing use of larger volumes of natural gas liquids in motor

THIS MONTH'S COVER PICTURE



Typical of modern natural gasoline plants now being built is the new Anahuac plant of Humble Oil & Refining Co., located not many miles from Houston. In the central processing area shown above the four tall towers at right are the main absorbers, operating at 800 psig. Towers at left are: main still (10 psig.), de-ethanizer (475 psig.), primary still (155 psig.) and reabsorber (140 psig.)

Table 1—Natural Gas Production and Utilization in Southwestern States
(From Interstate Oil Compact Commission Data)

(Thousands of cubic feet)

	Louisiana (11 mos. data)	Oklahoma (12 months)	Texas (12 mos. est'd)
Production:			
Dry Natural Gas	728,029,002	296,319,656	2,728,144,683
Sour Gas		Not Available	321,845,033
Casinghead Gas	216,255,533	203,127,730	764,319,439
Total	944,294,535	499,447,386	3,814,309,155
Pipeline Deliveries	545,683,500	77,027,929	1,781,677,221
Carbon Black	95,243,424	Not Available	331,857,916
Extraction Losses*	15,349,459	Not Available	118,480,114
Losses, including venting, flaring & well tests	66,761,048	Not Available	39,882,202
Repressuring, etc.	275,508,619	Not Available	668,133,134
Total	970,327,099		2,940,030,587**

* Equivalent to recovery of natural gas liquids.
** Total does not include gas produced and returned to ground in cycle plant operations.

fuels. The present trend appears to be for refiners to use more natural gasoline in blending. The general acceptance of more volatile motor fuels would create a large-scale market for gas liquids for blending with refinery gasoline. Also the amount of finished motor fuels made from gas liquids is growing, as cycle and natural gasoline plants install the "refinery processes" to let them manufacture motor fuels.

5. Growth in the markets for Liquefied Petroleum Gas. The rate of expansion may not keep up with the growth of the past decade but all indications are for continuing yearly gains in the LPG markets.

Underground reserves of natural gas liquids are higher now than ever before. In 1949 production amounted to but slightly more than 51% of new reserves added, so that a net increase of 188,229,000 bbls was chalked up. Proven reserves, according to reports of American Petroleum Institute and American Gas Association committees, now total 3,729,012,000 bbls. of gas liquids as of Dec. 31, 1949.

Similarly, API-AGA committees report natural gas reserves increased 6.51 trillion cu. ft. in 1949 to 180.38 trillion cu. ft. Gas production in 1949 was 6.24 trillion cu. ft. Crude oil reserves were 1.37 billion bbls. higher than the 1948 figure at the end of 1949, reaching 24.65 billion bbls. Production in 1949 was 1.82 billion bbls.

Natural gas production is expected to rise sharply in the 1950-53 period to supply the large number of natural gas pipe lines planned, authorized and under construction. In 1949 the Federal Power Commission authorized 13,400 miles of gas pipe lines and had applications pending for about 14,600 miles more. The majority of the "new" gas represented tapping gas fields in Texas. Even in 1949 gas sales by public utilities were up 10.9% over 1948, according to AGA, while an authority told the API at its last annual meeting FPC had authorized 2.6 billion cu. ft. of additional natural gas deliveries in the year ended June 30, 1949.

Increased gas production will have a corresponding effect on natural gasoline production also, but sufficient data are not available to warrant an assumption of the extent of the increase, as this will come gradually. However, natural gasoline plant operations and gas pipe lines have reduced the once much talked about "waste of gas" to a low figure. A glance at reports from the regulatory body show that in Texas, for example, the 1949 total of "waste" due to venting, well-testing, line losses and flaring was only 39,842,-102 Mcf in 1949—1.05% of gas production.

Most of the nation's gas now comes from the Southwest. Comparatively speaking, little new production has been discovered outside of Texas in the past two years although the enormous Hugoton Field of Texas, Oklahoma and Kansas has experienced extensive additions to its already proven acreage.

Table 1 has been prepared to show the amount of gas produced in Louisiana, Oklahoma and Texas in 1949 and what happened to it. Kansas has been excluded because figures are not available on only the gas produced in the state.

What is given in the table as "extraction losses" is in effect the contraction of the gas volume owing to the extraction of its natural gas liquids content. In other words, at present, natural gas and cycle plants account for only 1.6% of the total gas utilization in Louisiana and 4% in Texas. Pipeline deliveries and repressuring are the largest avenues of utilization. All natural gas processing is not accounted for in the "extraction losses." Much of the gas is "treated" for desulfurization and dehydration but is not processed for gas liquids recovery because of the "leanness" of the gas.

Gas Proration

Along with the automatic increase in natural gas liquids production which increased natural gas production will bring in its wake must be considered the possible effect of the future proration of both natural gas liquids and natural gas itself. As yet none of the state regulatory commissions has enunciated such a policy. However, this now being explored in Texas, the largest single gas-producing area.

Texas Railroad Commission Chairman W. J. Murray described the situation succinctly recently in stating: "Our drive against gas flaring has caused more and more cycling plants and natural gasoline plants to be built. Independent refiners complain of increasing competition from natural gasoline. They want a top allowable on cycling plants."

He added that the only present restriction on gas production is 25% of daily potential ability, and hence a distillate field could be cycled steadily to obtain liquids. Also, to fairly distribute market demand it might be necessary to prorate all gas fields, he stated. This would automatically affect natural gasoline and cycle plant production.

Proration for All Hydrocarbons

Even more recently the new Independent Refiners Assn. of America recommended to the Texas Railroad Commission that all petroleum hydrocarbons (from gas as well as crude oil) receive the same proration treatment. The association pointed out at a proration hearing that "a petroleum depression exists in Texas despite the highest record demand for petroleum products."

"One of the many factors contributing to this depression" it was stated, "is the advantage that gas petroleum hydrocarbons have found in the state proration regulations compared to the restricting effects of these regulations on crude oil hydrocarbons."

Refiners' arguments for including the output of natural gas liquids in the general proration scheme may become more insistent with the growth in the manufacture of finished motor fuels from gas liquids.

In line with increasing natural gas liquids production is the volume of finished motor fuel now coming from this source. While it is not possible to accurately determine the volume of such material, the data in Table 2 give a clue, taken from Bureau of Mines monthly reports. The heading "Finished Gasoline and Naphtha" is predominantly motor fuel, according to the Bureau.

It will be noted that this volume has increased 422,993,000 gal. in the past five years, or 176%. In the past three years, or since cycle and natural gasoline plant production has been separately reported, finished gasoline from cycle plants is up 50%; from natural gasoline plants about 66%. If distillate gas fields served by cycling plants are *not* prorated this trend in production of

Table 2—Production of Finished Gasoline and Naphtha by Natural Gasoline and Cycle Plants 1945-49

(U. S. Bureau of Mines Data)

(Thousands of gallons)

Year	Natural Gasoline	Cycle Plants	Total
1949	250,222	413,759	663,981
1948	206,919	323,785	530,704
1947	150,904	277,298	428,202
1946	.....	.....	355,113
1945	.....	.....	240,988

motor fuel may continue.

Until the war, the volume of finished motor fuel from natural gas liquids entering what heretofore were considered exclusively "refined gasoline markets" was not much of a factor. The bulk of production from both these and natural gasoline plants, and there were not very many cycle plants then, moved through refinery channels to market just as natural gasoline historically has moved.

During the war, cycle plant operators were encouraged to install leading facilities to help provide motor fuel and fractionation facilities to make various specialty cuts. Naturally, these plants prefer to continue to operate in this manner now, rather than to make a less valuable material for blending purposes.

Cycling Plant Products

An idea of the volume of all types of products coming from cycling plants may be had from Table 3, showing December production only, as reported by the Texas Railroad Commission, Louisiana production is estimated as approximately two-thirds that of Texas, with similar product distribution.

Industry authorities believe that any future cycling plants authorized probably will be equipped to make finished motor fuel. Moreover, in many cases existing plants which do not make motor fuel now may be expected to seriously consider adding processing equipment to upgrade the octane number of the finished motor fuel to well above present "regular" levels and in some cases equalling the "premium" range. Several cycling plants now are carefully surveying the production and economic factors involved in installing some form of reforming and possibly also catalytic polymerization.

In many cases, it will be necessary that the plants find a market for their product, in addition to up-grading it. But some, at least, argue that there is little choice in making a motor fuel rating below present "regular" grade levels when, for a reasonable cost, they can jump their octane rating by 10 points Motor Method and raise a negative sensitivity to a satisfactory spread. They believe they will make a greater profit in the long-run by selling their product direct as motor fuel than to dispose of the present product to a refinery.

At the present time there is considerable discussion but no general agreement on how small a reformer would be economically practical. The smallest catalytic reformer which has been installed in a cycling plant, according to one authority, has a capacity of 400 bbls. per stream day; another is scheduled for installation soon in a second plant.

Other authorities believe a unit of 1000 b/d or larger definitely will "be in the ball park", while units in the range of 500-1000 bbls. per stream day they consider "very small" units. One engineer considers that the minimum volume available for reforming should not be less than 1500 b/d; another puts the limit at 2000 b/d. One natural gasoline manufacturer is considering "package-type" skid-mounted catalytic reforming units, sized in 250 b/d multiples, for use in its plants.

In general, the reforming operation involves splitting out a 180 to 200° F. initial and 380 to 425° F. end point naphtha cut for reforming. The 200° F. end point cut is utilized for volatility and is not reformed. Instead it is blended back with the reformate which has been re-fractionated to the approximate boiling range of the initial reformer charge and thus produce a 12 or 13-lb. premium motor fuel of 95 to 100° F. initial boiling point and 380 to 415° F. end point. Such processes as thermal reforming, Perco Cycloversion and Platforming are being considered.

These authorities believe that additional cooperative ventures with several cycling plants pooling their naphtha production may be expected. The reformer will be located in some central spot, and the individual contributions either commingled and blended to a finished product, or the reformate returned to the owner.

Fewer New Plants in '50

A number of representative companies have said they do not anticipate constructing a single plant of their own in 1950. Several are involved with other operators and royalty owners in the construction of jointly-owned plants, however. In numerous cases it has been stated that at least some of the plants which may be authorized in 1950 cannot be justified solely for the return from production of natural gasoline and LPG. These will be built in order to conserve the liquid hydrocarbons from the casinghead gas which will be produced along with the crude oil and from pipeline gas. Any losses will be absorbed from crude oil or gas revenues in order to avoid potential trouble with regulatory authorities and a shut-down order for the field.

Table 3—Texas Cycling Plant Operations, December, 1949

(Texas Railroad Commission Data)

Item	Texas
Gas Throughput, Mcf.	71,162,143
Liquid Production, Total bbls.	2,076,504
Gasoline*, bbls.	1,160,000
LPG, bbls.	642,289
"Condensate-Crude" bbls.	215,481
Residues, bbls.	118,606

* Some natural gasoline included, but predominantly motor fuel.

At present at least four natural gasoline plants are being considered for the new Scurry County, Texas, area; two have been authorized. Capacities range from 26,000 to 40,000 Mcfd. Another company is considering a plant of 50,000 to 60,000 Mcfd. to yield 120,000 gal. of Grade 26-70 natural gasoline. If, as anticipated, the underground reef production characterizing this most oustanding discovery area of 1949 extends into adjoining Borden and Kent counties, perhaps additional plants will be justified, but most of these probably will not see drawing boards before 1951 and perhaps not be completed until 1952. There is no natural gasoline plant in the area now, even though Scurry has been booming for almost a year; the plants now announced will likely not operate until after mid-year.

New Plants outside Texas

In the balance of Texas outside the Gulf Coast area one authority expects five or six new plants to be authorized, ranging up to 20,000 Mcfd. capacity and yielding 1-1.5 gal. of Grade 26-70 per Mcfd. of throughput. According to this source, extensions to existing plants will total approximately 100,000 Mcfd.

On the Texas-Louisiana Gulf Coast it is anticipated that up to six new cycling plants processing a total of 500,000 Mcfd. of gas, for a yield of 0.3 gal. per Mcfd. will be built and approximately the same throughput will be secured through extensions to existing plants. In Oklahoma it is expected that two to three new plants will be authorized for a combined throughput of 125,000 Mcfd., with extensions to existing plants accounting for 50,000 Mcfd. more.

Table 4 has been prepared based on some authorities' estimates of the 1950 production of natural gas liquids in the Southwest. Since the production of natural gasoline and LPG is predicated on casinghead gas and condensate well production and to a lesser extent on dry gas production, the estimate is based on a mathematical relationship of gas liquids output to anticipated crude runs and natural gas production, rather than on an extrapolation of current trends.

The table is limited to the Southwest, comprising the Mid-Continent

Table 4—Natural Gasoline and LPG Estimated Production in 1950 in the Southwest

(Thousands of Gallons)

	Natural Gasoline	LPG	Total*
	1949*		
Mid-Continent	2,062,206	1,031,103	3,093,309
Texas-Louisiana Gulf Area	1,098,873	549,436	1,648,309
Total Southwest	3,161,079	1,580,539	4,741,618
	1950		
Midcontinent:			
Estimated 1950 production from Existing Plants	1,546,655	773,327	2,319,982
New Plants and Extensions	261,823	123,195	325,018
Plants Under Construction	135,781	61,890	197,671
Total	1,884,259	958,412	2,842,671
Texas-Louisiana Gulf Area:			
Estimated 1950 Production from Existing Plants	824,155	411,077	1,235,232
New Plants and Extensions	105,000	52,500	157,500
Plants Under Construction	12,372	921	13,293
Total	941,527	464,498	1,406,025
Total Southwest	2,825,786	1,422,910	4,248,696

* U. S. Bureau of Mines Data

and Texas-Louisiana Gulf Coast, for it is here that most of the country's flush (proratable) crude oil and gas production occurs, except for California.

In setting up the estimates, it was first assumed that a 25% reduction in production from existing natural gasoline and cycling plants will take place, reflecting reduced crude allowables in Kansas, Oklahoma, inland Texas and the Texas-Louisiana Gulf areas. To this has been added expected recoveries from new plants under construction, as well as recoveries from plant extensions. As a rough approximation, LPG production is taken as one-third of the total gas liquids production. In setting up the figures also an attempt has been made to consider the possibility of prorating production of cycling plants and perhaps all gas fields in Texas as tentatively advanced recently by the Texas Railroad Commission.

By this calculation it appears that 1950 natural gasoline production will be 8.6% less than 1949 in the Mid-Continent while LPG will be down 7.0%, for a total liquids production decrease of 8.1%. In the Texas-Louisiana Gulf the decreases will be 14.4%, and 15.4%, respectively, with the total 14.7%. In the Southwest as a whole, natural gasoline production will decrease 10.6%, LPG by 10.0% and total liquids production, 10.4%. These estimates presuppose there will not be a major war in 1950 or a substantial change in crude imports beyond current forecasts.

It must be stated, however, that other authorities disagree with the 1950 gas liquids production estimate as shown in Table 4. Some believe there will be an increase in gas liquids output of 4 to 6% for 1950.

1950 Plant Design

What will the plants and extensions built in 1950 be like? Will the trend towards high propane recovery continue? Will cycling plants to be constructed have facilities for upgrading the octane number of the product—natural gasoline or finished motor fuel? A number of representative engineer-contractors and natural gasoline and cyling plant operators were interviewed for their answers to these questions.

The consensus is that, in general, most natural gasoline plants will *not* go for propane recoveries in the 50 to 80% or higher brackets except in unusual cases where a market for the light hydrocarbons seems assured. However, most plants will be designed so that additional equipment for the recovery of the remaining propane and butane may be added at some future time.

In some cases pumps and plant utilities will be sized for the increased recovery, in others the facilities will be designed for the later addition of refrigeration and cooling equipment, and the plants laid out for the ready installation of the extra columns, compressor equipment, and the like, which will be required.

Light hydrocarbon recoveries to be sought will range from 50 to 90% butane and "incidental" propane (10 to 30%, in general, but up to 50% in some cases) depending on the richness of the gas processed.

A new dehydration process was introduced in a commercial plant (Carthage Corp.) by Hudson Engineering Corp., utilizing a new liquid desiccant of undisclosed composition to produce low dew points. This same firm also utilized Dowtherm as a heating medium instead of steam where high temperatures and precise control of heat delivery is required.

The largest problem of the natural gasoline manufacturer and cycling plant operator is the long-standing one of finding a stable market. For the first time in several years there has been the situation of overproduction and underconsumption with consequent depression in price, added to the historical seasonal demand fluctuation.

The plant operators cannot afford to build enough above-ground storage to permit steady production and underground storage in sand formations. Proven successful under certain conditions, this is by no means universally applicable. There also is the question of realizing plant costs and interest on investment represented by this stored material, at least some of which must be recovered and re-run before it again becomes salable. Increased consumer storage is a partial answer, and is being pushed.

Unfortunately from the short-term standpoint, the new plants have come onstream at a time when historical markets are least able to absorb the increased output. The export market has dropped to relative insignificance, as revealed in Bureau of Mines statistical reports. These show natural gasoline blended at refineries increased 12.3% in volume in 1949 over 1948 (85,632,000 bbls. vs. 76,237,000 bbls.) while that used direct as motor fuel, representing exports, losses and movement of stabilized gasoline to marketers, dropped nearly 15% (20,705,000 vs. 24,348,000 bbls). The total volume of natural gasoline used in motor fuel, including exports and losses, was approximately 11%, substantially unchanged from 1948.

Lest the reader be confused by the fact that motor fuel demand remained relatively steady in 1949 and yet natural gasoline is reported as being in oversupply, it should be remembered that, with the advent of catalytic cracking equipment, many refineries also installed efficient gas recovery facilities. In consequence, after using their own light ends in blending, many refiners now have excess volatility, which they sell as LPG in direct competition with the natural gas liquid industry's LPG.

LPG is relatively in lesser demand currently than natural gasoline, with potential production the greater because of the recent trend for high recoveries of propane and butane in the new plants and extensions completed in 1949. Demand was down by reason of another abnormally warm winter in the areas of largest consumption, the same as with fuel oils from crude petroleum.

Many in the natural gasoline and cycling plant industry believe that ultimately large-scale use of their products will be achieved, and the cause of conservation advanced, through increasing the volatility of motor fuels generally marketed.

It is evident, on the basis of work such as the Nowata Road Tests sponsored by the Natural Gasoline Assn. of America a few years ago, and other competent data submitted to the automotive engineers, that there is room for increasing the volatility of present-day motor fuel without inviting serious vapor lock troubles. One authority has estimated that an average year-round increase of only 0.5 lb. in vapor pressure in all motor gasoline sold in the U. S. would require 6,000,000 bbls. of butane annually, or several times that much natural gasoline.

These are among the leading petroleum companies with Kellogg designed-and-constructed Propane Deasphalting and Decarbonizing units:

- Anglo-Iranian Oil Company, Ltd.
- British American Oil Co., Ltd.
- Cities Service Refining Corp.
- Cie. Francaise de Raffinage
- Gulf Oil Corporation
- Humble Oil & Refining Co.
- Kendall Refining Company
- Mid-Continent Petroleum Co.
- The Pennzoil Company
- Phillips Petroleum Company
- Pure Oil Company
- Shell Oil Company
- Sinclair Refining Company
- Standard Oil Company (Ohio)
- The Texas Company
- Utah Oil Refining Company

4 out of every 5 barrels of Propane-Deasphalted oil are processed in Kellogg-designed units!

Yes! Kellogg has engineered and built over four-fifths of the world's Propane Decarbonizing and Deasphalting capacity . . . and there's more under construction!

WHEN it became obvious years ago that asphalt-free crudes would not meet the growing demand for lubricating oil stocks, development work was started to obtain quality lube stocks from asphaltic crudes. Eventually this development work grew into the familiar JUIK (Jersey-Union-Indiana-Kellogg) series of propane processes, basic among which was Propane Deasphalting. First utilized successfully as a settling process in horizontally-positioned equipment, Kellogg later developed the present counter-current tower method.

Efficient, non-critical in operation, and extremely flexible over a wide range of feed and product specifications, Kellogg engineers subsequently saw in the basic principles of the process an excellent method for reducing the carbon content of cat cracker feed stock, thus increasing the potential capacity of any cat cracker. Kellogg has designed and sold such units since 1942.

As licensing agent for all such projects, and as the designer and builder of more than four-fifths of the world's capacity, M. W. Kellogg offers unduplicated background to refiners considering addition of such facilities.

PILOT PLANTS PLAYED MAJOR ROLE IN PERFECTING PROPANE DEASPHALTING!

If any refining process owes its acceptance to pilot plant work, most certainly it is Propane Deasphalting. Kellogg's first pilot plant for this process was started back in the early thirties. It was followed by others, including the latest pilot unit pictured here. Operating characteristics and economics were so thoroughly investigated on these pilot plants in hundreds of separate runs that widespread commercial acceptance of the process was achieved practically overnight on the basis of pilot plant data.

IT TAKES ALL SEVEN TO PRODUCE GREATER EARNING POWER . . .

3. SPECIALISTS IN EVERY PHASE
of DESIGN ENGINEERING in true depth. There are, for example, 14,000 square feet of floor space devoted to piping engineering alone . . . eight separate divisions to parallel the eight major phases of refinery engineering: piping, heat transfer, vessel and furnace, equipment, instrumentation, structural, electrical and operation. And behind this array of personnel is an exclusive compilation of data, continually created and collected during more than thirty years of the oil refining industry's greatest growth. From "Equilibrium Constants" to "Design of Piping Systems," both considered authoritative tracts within the industry, to special standardized templates for drawings, the Kellogg organization puts in the hands of its Engineering Division every necessary "tool" to deliver outstanding performance.

1 THE DEVELOPMENT "TOOLS"
—laboratories, pilot plants and recognized specialists to prove and improve processing and equipment ideas.

2 PROCESS ENGINEERING
by three distinct groups of specialists—*sequence* engineers, *unit* engineers and *development* engineers—supported by an extensive reservoir of exclusive data.

4 SPECIALIZED BUYERS
backed by the cumulative buying power of the largest company in the business.

5 COMPLETE FABRICATING FACILITIES
to make schedule deadlines and to develop workable "firsts" in refinery equipment.

6 CONSTRUCTION KNOW-HOW
acquired in completing hundreds of major jobs, plus an ample supply of the proper tools, and the constant development of new money-and-time-saving methods on the construction lot.

7 PRACTICAL OPERATING COUNSEL
on all design and construction, achieved through practical operating men working as an integral part of the company.

. . . AND ONLY KELLOGG HAS ALL SEVEN!

The M. W. Kellogg Company, (a subsidiary of Pullman, Inc.), New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris — KELLOGG

Trends in the Design of New Plants For Recovering Liquids from Gas

By CHARLES F. SANDERSON and ALAN S. GLENDENING

Sanderson-Glendening, Consulting Engineers, Houston

The many natural gasoline plants built in recent months have indicated a number of interesting trends in design. Among these are larger capacity, the use of hot oil instead of steam for heaters, the use of air instead of water for cooling, greater utilization of refrigeration, higher recovery of propane, wider use of rich oil stabilizers, increased interest in sulfur removal and other problems involved in handling sour gases. The ten plants discussed in this article cover a wide range in thinking, since no two of them were designed by the same engineers. Plant sizes range up to 385 MMCFD.

THE past year and a half has seen the completion of a number of gasoline plants incorporating some very interesting features. The process designers responsible for these installations have shown considerable ingenuity in overcoming problems related to high propane recovery, sour gas, poor water and large plant size. It is not possible to examine here every plant completed during this period, but the ten plants discussed represent an excellent cross-section of the present trends in the solutions of the above problems. It is interesting to note that no two of these plants were designed by the same firm. Any remarks as to the intentions of the designers represent deductions on the part of the authors from such information as is available in the literature.

The tendencies indicated by these recent plants may be outlined as follows:

1. Large size. Several of these plants are among the largest ever built.

2. Hot oil heating and air cooling. These frequently have been used to replace steam heating and water cooling.

3. Increased use of refrigeration. A few plants have made use of refrigerated absorption in the initial design.

4. Elimination or suppression of "non-condensible" plant vapors. There has been an increase in the use of rich oil stabilizers and/or two stage absorption oil distillation to control non-condensible plant vapors (methane and ethane).

5. Increased propane recovery. Fewer plants than in previous periods sought to increase propane recovery.

6. Dehydration and treating systems. The use of lower processing temperatures and the desire to process sour gases has increased the importance of systems for drying the gas and removing its sulfur.

It is interesting to note how some of the latest installations illustrate these trends.

Large Size

Although none of the recent plants approached the production of Humble Oil and Refining Co.'s Katy installation, several were very large by usual standards. The Slaughter plant[1] in West Texas, built by C. F. Braun and operated by Stanolind Oil and Gas Co. is designed to process 90 MMCFD of a sour gas and produce 242,000 gpd. of propane, butane and natural gasoline. The Dubach, La., plant[2], built by Fish Engineering Co. for Southwest Gas Producing Co. and W. C. Feazel, was designed for an initial throughput of 90 MMCFD and a production of 230,000 gpd. of propane, butane, natural gasoline, naphtha, kerosine and gas oil. Future operation contemplates the handling of 120 MMCFD with an attendant increase in production to 295,000 gpd. The Garvin County, Oklahoma, installation[3], built by Dresser Engineering Co. and operated by Warren Petroleum Corp., is initially handling 80.5 MMCFD to produce in excess of 300,000 gpd. of propane, butane and natural gasoline. The equipment is sized for a future throughout of 100 MMCFD. The plant at Carthage, Texas[4], built by Hudson Engineering Corp. for the Carthage Corp., has a design throughput of approximately 385 MMCFD and produces an unannounced, but obviously very large, quantity of propane, butane, natural gasoline, naphtha, kerosine, mineral seal oil and residuum.

The size of these plants necessitates the paralleling of the process streams at various points. Since it appears to be uneconomical to build high pressure absorbers larger than about 6 ft. in diameter, some of these plants make use of parallel absorbers: Dubach uses three, Slaughter has two, and Carthage uses seven. The oil circulation and production of the Garvin County unit are sufficiently large to warrant two complete parallel absorption oil distillation systems. This unusual installation consists of three separate plants, two of them serving primarily as remote absorption stations and the third being a complete plant capable of processing the rich oil from its own absorbers

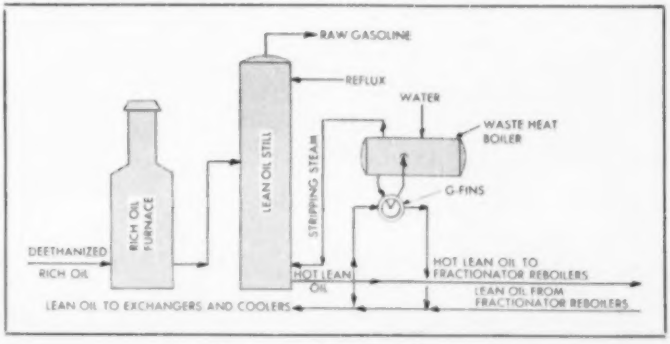


Fig. 1—Oil heating at Newhall-Potrero plant

plus that from the distant ones. The remote absorbers are supplied with lean oil from the main unit. The arrangement is presumably more economical than one involving three separate plants each with its own distillation, utility, and storage facilities.

Hot Oil Heating and Air Cooling

Wherever water is scarce or of poor quality, and even in some locations where water is plentiful, hot oil heating and air cooling are replacing boilers and cooling towers as plant utilities. The modern high recovery plants tend to require higher pressure, and therefore higher temperature, absorption oil distillation. The use of a circulating oil heated by a furnace makes possible higher temperatures than could be obtained by steam heating at reasonable boiler pressures. The problems of control and lower heat transfer rates have been solved by careful attention to operability in plant design. Hot oil heating has been applied ingeniously in Barnsdall Oil Co.'s Newhall-Potrero plant[5], partially shown in a considerably simplified form in Fig. 1. All the heat necessary for the absorption oil distillation is supplied by a single furnace. Lean oil from the still furnishes all the heat necessary for the rich oil deethanizer, depropanizer, debutanizer and, in addition, generates the still stripping steam in a waste heat boiler. No high pressure steam is available for the process pumps, so high pressure gas, warmed by this same hot lean oil, is used prior to being burned as fuel. Such an arrangement as is used in this plant may be termed an "interlocked system", in that the circulating heating medium is one of the process streams, in this case the lean oil. Because of its superior thermodynamic efficiency, this scheme has been employed in most of the installations where hot oil heating was desirable. However, in any interlocked system there is a danger of a loss in the flexibility of operation for the individual units. For this reason it is sometimes desirable to use an independent oil stream for heating, i.e., one completely divorced from the absorption oil distillation system. The Garvin County's central plant makes use of such a system.

Air cooled units have been used for many years for engine jacket water cooling, but it has been only recently that they have come into extensive use for process cooling. The incentive for their development along these lines has been the necessity for installing plants in arid regions. However, with the accumulation of better design data the opinion has grown that they are applicable in many locations where there is a plentiful supply of good water. In the opinion of one manufacturer of both types of equipment, air cooling is not competitive with water cooling for process stream temperatures below about 140° F. if there is a good supply of water available. However, since much of the cooling and condensing load in these plants is in the 140° to 170° F. range, it is probable that air cooling will find many applications in the future. In the recently completely plants the degree of usage varies widely. Bransdall Oil Co.'s Newhall-Potrero plant uses it only for cooling the engine jacket water and primary condensation of the lean oil still overhead. The Garvin County plants have, in addition to the above, an air cooled debutanizer condenser. The Carthage plant, for which there is a limited supply of poor water, uses air cooling for the three services already mentioned plus all the heavy product condensers and the exhaust steam condenser. This plant also has a most unusual heating system which, while not falling under the heading of this section, is well worth a few remarks. Two boilers producing 600 psig. steam superheated to 750° F. supply the requirements of major pump turbines and some of the hottest process heating units. Steam from the largest pump turbine, exhausting at 170 psig., provides stripping steam and drives all the other turbines in the plant. These, in turn, exhaust to a low pressure header which supplies heating steam to those units requiring only moderate temperatures. The system, utilizing an air cooled steam condenser, runs totally condensing. In addition to the above system, this plant also incorporates two large vaporizers supplying saturated Dowtherm vapor, at 650° F., to the reboilers on the four heavy product fractionators.

Refrigeration

Until recently refrigeration has been applied to absorption plants only where it was desired to increase the recovery in an existing installation. The indications were that high recovery in a new installation could best be achieved by a high oil circulation rather than by maintaining a colder absorber. However, in some circumstances it appears that the lowered oil circulation, higher selectivity between components at the lower temperatures, and the reduction of plant vapors outweigh the extra cost of refrigeration and dehydration equipment, particularly in high recovery plants. Two plants incorporating refrigeration in their original designs are the recently completed General Petroleum Corp.'s Burrel, California, unit[6], built by Bechtel McCone Corp., and the previously mentioned Dubach plant. Both of them refrigerate the wet high pressure gas and the lean absorption oil to about 60° F., and claim about 80% propane recovery.

A striking feature of the Dubach plant is the use of a very light absorption oil (49° F. A.P.I. and 155 mol wt.). According to the designers this oil, in conjunction with the low absorption temperature, makes possible a 50% reduction in the oil circulation required and, therefore, a large reduction in the size of the equipment handling this oil. With such a light oil it is necessary to operate with the top of the absorber at a low temperature to avoid an excessive loss of oil into the residue gas (Fig. 2a). However, the lower temperature of the departing residue gas may represent a considerable loss in refrigeration, and this factor must be taken into account in the economics of this arrangement. Usual practice in the past has been to apply refrigeration through intercoolers, thus permitting a higher residue gas temperature (Fig. 2b).

The Garvin County, Okla., installation achieves an interesting design by refrigerating only at the top of the deethanizer (Fig. 3). In addition to making possible a lower operating

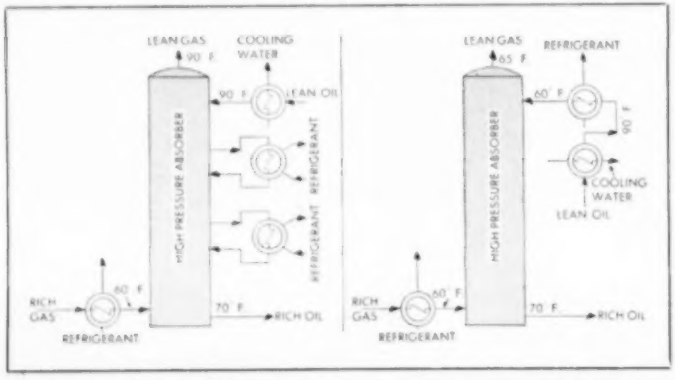
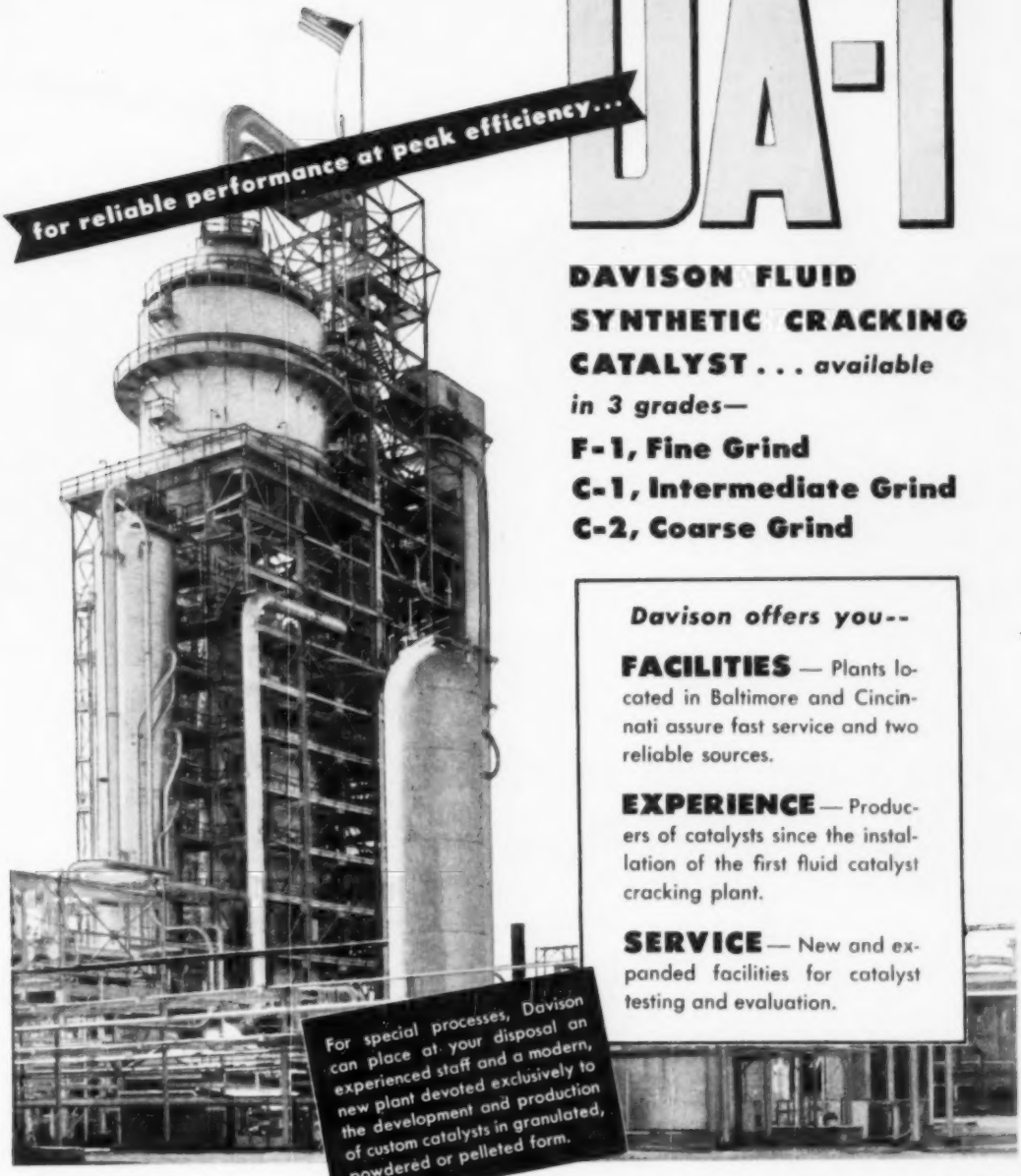


Fig. 2a—Intercooled absorber *Fig. 2b—Non-intercooled absorber*

DA-1®

for reliable performance at peak efficiency...



DAVISON FLUID SYNTHETIC CRACKING CATALYST . . . *available in 3 grades—*

F-1, Fine Grind
C-1, Intermediate Grind
C-2, Coarse Grind

Davison offers you--

FACILITIES — Plants located in Baltimore and Cincinnati assure fast service and two reliable sources.

EXPERIENCE — Producers of catalysts since the installation of the first fluid catalyst cracking plant.

SERVICE — New and expanded facilities for catalyst testing and evaluation.

For special processes, Davison can place at your disposal an experienced staff and a modern, new plant devoted exclusively to the development and production of custom catalysts in granulated, powdered or pelleted form.

WRITE FOR INFORMATION AND SPECIFICATIONS

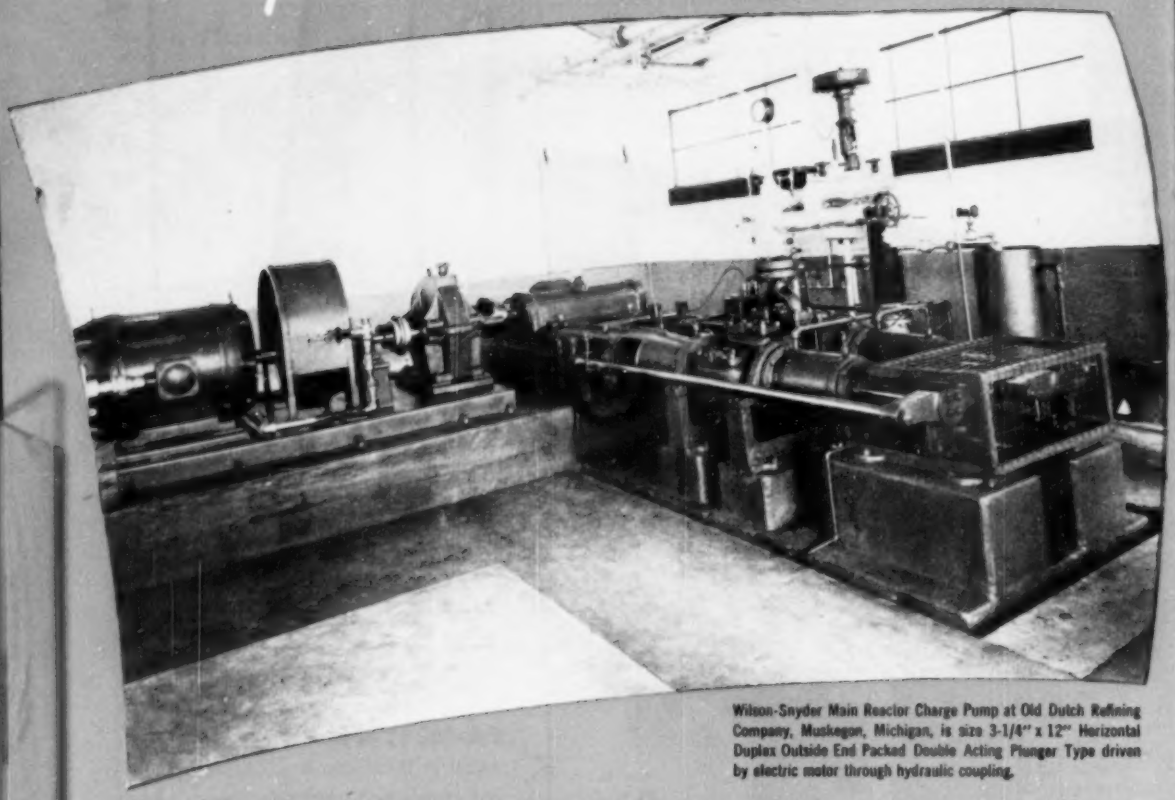
THE DAVISON CHEMICAL CORPORATION

Progress through Chemistry

BALTIMORE-3, MD.

ALSO PRODUCERS OF: SILICA GEL, SILICOFLUORIDES, CASTING COMPOUNDS, ALUM, INORGANIC ACIDS, FERTILIZER MATERIALS, ASPHALT COMPOUNDS

We are proud to be on the team!



Wilson-Snyder Main Reactor Charge Pump at Old Dutch Refining Company, Muskegon, Michigan, is size 3-1/4" x 12" Horizontal Duplex Outside End Packed Double Acting Plunger Type driven by electric motor through hydraulic coupling.

Wilson-Snyder Pump selected for the "heart" of UOP Platforming Process

PLATFORMING . . . the petroleum refining process that utilizes a catalyst containing platinum . . . was discovered and developed by Universal Oil Products Company. The process is employed to improve the octane characteristics of straight run and natural gasolines, and has already proved its merit in commercial operation at the Muskegon, Michigan refinery of Old Dutch Refining Company.

Wilson-Snyder Refinery Pumps have long enjoyed an excellent reputation for performance and reliability. That is the reason UOP selected a Wilson-Snyder as the Main Reactor Charge Pump for this first platforming installation.

You, too, can DEPEND on Wilson-Snyder Refinery Pumps . . . especially in critical process operations where performance and reliability count the most.

A complete line of Wilson-Snyder reciprocating and centrifugal pumps are available for all types of refinery operations. Write for engineering information.

OIL WELL SUPPLY COMPANY

Wilson-Snyder Manufacturing Division
Braddock, Pa.

And all Oil Well Supply Company Offices

USS "OILWELL"

UNITED STATES STEEL

pressure, this arrangement lowers the amount of propane in the non-condensible overhead vapor. Since this plant has no boilers, this gas, consisting almost entirely of methane and ethane, is used to strip the absorption oil in the still. Because of its low propane content, there is no fear of reducing the absorption efficiency of the oil. The single biggest disadvantage of this system is that the stripping vapors are not condensed, as steam would be, but must continuously recycle through the still, condensers, recompressor, deethanizer and back to the still again. This requires that these units be larger than usual.

In order to use low deethanizer reflux temperatures without the danger of hydrate formation, it is necessary to dehydrate the feed to this column. This is done by passing the feed stream, as a liquid, through a bed of solid desiccant. Removal of water at this point not only prevents hydrate trouble in this tower, but also makes it unnecessary to dehydrate the propane product further on in the process.

Reduction Of "Non-Condensible" Vapors

The problem of eliminating methane and ethane from absorbed liquids without undue loss of propane and heavier hydrocarbons continues to tax the ingenuity of process engineers. The older plants found it necessary to recycle large streams of non-condensible plant vapors to a reabsorber to minimize losses of desirable components. This added stream required recompression horsepower, larger equipment and accessories. In the more recent plants two methods of reducing or eliminating these uncondensed vapors have become almost standard. These are, first, rich oil stabilization and, second, two stage absorption oil distillation.

A rich oil stabilizer is generally a bottle-shaped column containing about 40 trays, in which rich oil from the absorber is reboiled by exchange with hot lean oil and refluxed with cold lean oil. The purpose is to eliminate most of the methane and ethane early in the process and thus unload the recompressor, still condenser and deethanizer which follow. It is possible for efficient rich oil stabilization to permit total condensation of the still overhead at a reasonable pressure and to eliminate the recompressor and the deethanizer. Two illustrations will serve to show recent applications of the rich oil stabilization scheme.

The unit in Barnsdall's Newhall-Potrero plant (Fig. 4a) is reboiled by exchange with hot lean oil, using two banks of heat exchangers. The rich oil is withdrawn four trays below the feed point and pumped to the side reboilers at about 125° F. This makes it possible for the lean oil to leave the heat exchange system at a fairly low temperature, thereby improving the thermodynamic efficiency. Oil from the bottom tray is reboiled at about 415° F. in a second bank of exchangers, the vapors therefrom proceeding up the column to strip the descending oil.

A somewhat different heating arrangement is used in the Slaughter plant (Fig. 4b). Heat is applied to the rich oil stabilizer only at the base, partly by exchange with hot lean oil and partly by exchange with hot oil in an independent heating system. With this arrangement the lean oil will go to the lean oil coolers at a higher temperature than with the system in Fig. 4a.

Rich oil stabilizers are generally referred to as either rich oil deethanizers or rich oil demethanizers, depending on the extent to which light ends are eliminated from the rich oil. Those at the Slaughter and Barnsdall plants just mentioned evidently do a very thorough job of eliminating ethane, since no deethanizer is necessary in the fractionation system to produce propane of the desired purity. The central plant at the Garvin County installation has a rich oil stabilizer arranged as in Fig. 4b, except that oil is cooled part way down the upper (reabsorption) section of the tower. In this plant, the rich oil is not completely stabilized, so that a conventional deethanizer column is necessary in the fractionation system.

In this connection, there seems to be evidence that designers are reluctant to entrust the entire deethanizing load to a rich oil stabilizer where high propane recoveries are sought. Generally, they prefer to remove all the methane and most of the ethane in this unit, then remove the remaining ethane in a conventional fractionator. The Elk Basin, Wyoming, plant[7], built by Stone and Webster for Stanolind, apparently recovers about 75% propane using

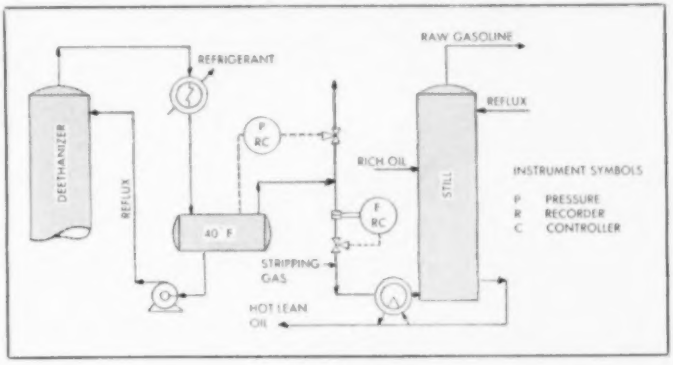
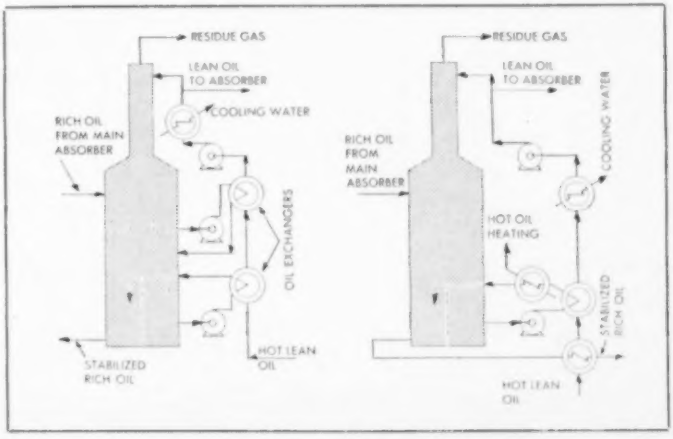


Fig. 3—Stripping with gas



Figs. 4a (left) and 4b—Rich oil stabilizing schemes

this arrangement. Where lower recoveries are acceptable, the deethanization is likely to be done entirely in the rich oil deethanizer, as in the case of the Slaughter plant, where the design is for 32% propane recovery.

Several plants have made use of a two stage oil distillation rather than the rich oil stabilizer. At high propane recoveries it is desirable to operate the absorption oil distillation at high pressures in order to condense as much of the overhead product as possible. With a single still, however, this high pressure would require an excessive amount of stripping steam. The two-still arrangement avoids this difficulty. The first still is operated at a pressure high enough to condense most of the raw product while only partially stripping the oil. The final stripping is performed in the second still at low pressure, where the overhead is completely condensed and pumped into the final condenser of the high pressure still.

The TXL plant[8], built by Brown and Root Co. for Shell Oil Co., Inc. and the Texas Co., incorporates an interesting two still arrangement (Fig. 5). Since the main absorber operates at only 200 psig., it is possible to recycle the uncondensed vapor from the high pressure still back to this absorber. Thus the main absorber also fulfills the role of a reabsorber. The fractionation system includes a deethanizer, from which the uncondensed overhead is also recycled to the main absorber. In addition, a rather unique arrangement of furnace and heat exchangers between the stills makes it possible to preheat the feed and reboil the bottom of the low pressure still with heat from this single source.

Most two stage installations are similar to that shown in Fig. 5, except that recycling of the high pressure still overhead vapors to the main absorber may not be convenient. In this eventuality the plant will contain a reabsorber to remove heavy ends from the plant vapors. Operating pressures of the two stage systems vary according to the volatility of the material being handled and the temperatures used. At the Dubach plant the high pressure still operates at 155 psig. and the low pressure still at 5 psig., with stripping being performed at 390° F. in both. At the Silsbee plant[9], built by Gasoline Plant Construction Co. for American Republics Corp., the stills operate at 180 psig. and 40 psig., with 400° F. stripping temperatures. Only the low pressure still is reboiled in the Dubach plant, but in the Silsbee plant both stills are reboiled.

The Burrel plant contains an interesting feature in that deethanization and depropanization are apparently performed in a single column. This is accomplished by withdrawing most of the propane at a side draw point about 6 to 10 trays from the top of this column, and removing the remainder of the propane and the lighter components as vapor from the overhead accumulator. These vapors are then recycled to an absorber. It is not clear from the literature how pure a propane can be produced by this method without stripping in an additional column. However, it appears that the plant is presently operating without an additional stripper.

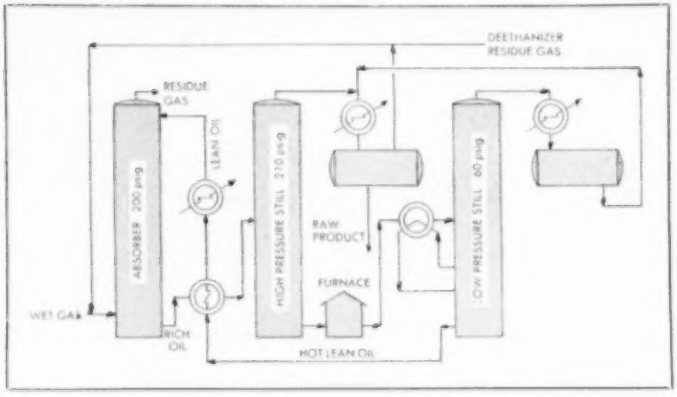


Fig. 5—TXL plant absorption and distillation (simplified)

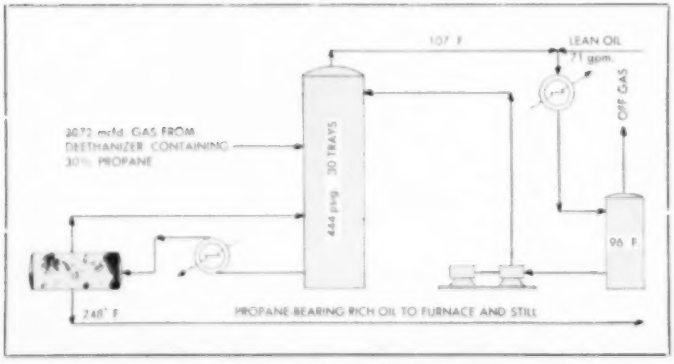


Fig. 6—Shell Sheridan absorber-stripper

Increased Propane Recovery

One of the few recent plant revisions for increased propane recovery was that the Sheridan, Texas, cycling plant[10], built by Petroleum Engineering Inc. for Shell, where the propane recovery was increased from about 30% to 55%. This was done by installing a fractionating absorber (sometimes called an absorber-stripper) operating on the deethanizer tail-gas at 444 psig. (Fig. 6). About 85% of the propane in this gas is recovered in the column. Excess oil circulation capacity was available to reflux this column, and an existing column was converted to this service. The bottom product containing absorption oil plus propane of a high degree of purity (97 plus % in the storage tanks) is returned to the absorption oil still for distillation. The over head vapor cooler removes the heat of absorption and the lean oil going to the tower is presaturated with light ends by mixing it with overhead vapors ahead of the cooler.

Dehydration And Treating Systems

The most unusual treating problem of the last year and a half was probably that encountered at Stanolind's Elk Basin plant. The problem can be appreciated by considering that the feed gas contains 2% nitrogen, 6% carbon dioxide and 18.5% hydrogen sulfide. The following streams leave the plant, every one of which must be regarded as a product: propane, butane, natural gasoline, 500 psig. sales gas, 1500 psig. inert gas

and sulfur. The gas throughput is 12 MMCFD from which 74 long tons of sulfur are produced, and 14 MMCFD of inert gas is used for reinjection into the field. Thus pressure is maintained in the formation while residue gas is sold to a pipeline. The sequence of operations which makes all this possible is as follows: rich sour gas at slightly above atmospheric pressure is compressed through three stages to the main absorber at about 500 psig. Between the first and second stages the gas is treated in a low pressure amine absorber, where part of the hydrogen sulfide and carbon dioxide are removed. Between the second and third stages of compression the remaining hydrogen sulfide and carbon dioxide are absorbed in a high pressure amine absorber. The system supplying amine solution to these two absorbers and subsequently reactivating the solution is of the "split-flow" type. That is, the reactivator supplies a partially stripped solution to the low pressure absorber and a completely stripped solution to the high pressure absorber. Such a system, while requiring less utilities than the usual single stream system, is probably only economical for larger installations because of its greater complexity. The gas off the amine system contains practically all of the hydrogen sulfide which enters the plant. It is processed in a modified Claus process for the recovery of elemental sulfur.

The inert gas for reinjection is produced by burning plant fuel in a boiler designed especially for close combustion control with a deficiency of oxygen. This flue gas is then cooled and compressed to 1500 psig. for reinjection. With complete combustion, one volume of methane will burn to about nine volumes of water free flue gas, so presumably the normal fuel gas requirements of the plant should supply sufficient gas for reinjection to replace the gas withdrawn from the formation. In addition, some of the inert gas produced is available for lowering the BTU value of the sales gas and at the same time increasing its volume.

In addition to the gas treating system described above, other treating includes a caustic wash and solid dessiccant for the removal of sulfide and water from the propane product, a caustic wash for the removal of sulfide from the butane-gasoline mixture, and a copper chloride treatment for the removal of mercaptans from the natural gasoline product.

In the field of dehydration, there seems to be a continued division of opinion as to the relative merits of solid and liquid desiccants. In order to obtain very low dew-points, say lower than 20° F., there is no argument; only a solid desiccant can conveniently handle the job. For dew-points required by most pipe lines, about 30° F., liquid desiccants such as glycol are as satisfactory as solid ones and have the advantage of operating on continuous rather than batch systems. The use of cycle timers can, however, render the solid desiccant processes fully automatic. The main difficulty in arriving at low dew-points with glycol dehydration lies in the problem of obtaining high glycol concentrations without decomposing the glycol. At both the Slaughter and the Carthage plants liquid desiccant concentration is carried out under vacuum. At the Slaughter plant diethylene glycol is concentrated to 97-98% at 8-9 psia. The Carthage plant makes use of a new liquid desiccant the nature of which is unannounced. It is claimed that this new desiccant is capable of obtaining a greater dew-point depression than is possible with glycol. The design was for the dehydration of a 110° F. gas to a water content of 7 lbs./MMCF. Actual performance has resulted in only 4 lbs./MMCF. This corresponds to a dew-point depression of about 90° F., which is extremely high for a liquid desiccant.

Conclusion

From the above comments on a relatively few of the many plants designed and built during the past eighteen months it can be seen that plant design in this industry is far from static. As the economic conditions within the industry change, so also will the processes used in its plants. The trends noted in this article may continue in their present directions, or they may reverse. In either case it will be absolutely necessary for everyone concerned with design, construction and operation to keep closely in touch with the latest developments, lest a supposedly modern installation prove to be merely a marginal proposition after it is built.

References

(1) "Slaughter Gasoline Plant," by J. S. Bellah, R. V. Mertz and J. W. Kilmer, *Petroleum Engineer*, 21, no. 6, A-35 (1949).

(2) "Ethane and Propane Separation Greatly Simplified at Dubach," by C. R. Ames and T. D. Tabbert, *Petroleum Refiner*, 28, no. 5, 117 (1949).

(3) "New Plant Strips Wet Gas in Field for Central Handling of Rich Oil," by D. P. Thornton, Jr., PETROLEUM PROCESSING, 5, no. 2, 135 (1950).

(4) "Unusual Processing Arrangements Used in New Carthage Gasoline Plant," PETROLEUM PROCESSING, 4, no. 12, 1359 (1949).

(5) "Design and Construction Details on Barnsdall's Newhall-Potrero Gas and Gasoline Plant," by Melroy Welch, *Oil and Gas Journal*, 48, no. 30, 73 (Dec. 1, 1949).

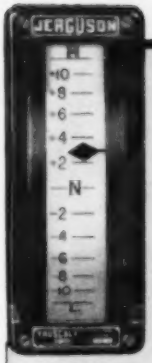
(6) "80% Propane Recovery in Burrell Gasoline Plant Exceeds its Design Figure," by M. E. Garrison, PETROLEUM PROCESSING, 4, no. 4, 395 (1949).

(7) "Elk Basin Plant Termed Real Conservation Project," by L. R. Lyon, R. A. Feagan, Jr., and H. B. Manley, *Petroleum Refiner*, 28, no. 10, 116 (1949).

(8) "TXL Plant Conserves 50,000,000 Ft. of Gas," by Arch L. Foster, *Petroleum Engineer*, 21, no. 1, C-7 (1949).

(9) "Combination Gasoline Plant Goes on Stream at Hilsbee," by W. T. Bryant, *Petroleum Refiner*, 28, no. 5, 128 (1949).

(10) Sheridan Plant Revisions—Data obtained from Petroleum Engineering Inc. by permission of Shell Oil Co.



Assures Positive Distance Reading of Liquid Levels

JERGUSON TRUSCALE GAGE

THE modern design JERGUSON TRUSCALE GAGE gives new accuracy for reading of liquid levels in boilers, deaerating tanks, etc.

Here is the distance reading gage which incorporates all of the newest engineering features! The Jerguson Truscale has exceptional sensitivity, with the ability to register changes as small as ½ of 1% of range! The translucent dial scale is clearly lighted from behind, and is easy to read.

The Truscale Gage may be equipped with positive alarm system. Lights flash and horns sound at specified key points when liquid level falls dangerously low or rises too high. Foolproof anti-surge mechanism for use on ships. Available for panel, pedestal, or wall mounting. It will pay you to investigate.

JERGUSON TRULEVEL GAGE

Hydrostatic type distance reading gage with inverted U-tube manometer. Water level always visible with space above showing brilliant red. Built-in feature makes possible checking of gage accuracy in few seconds.

Write today for free illustrated DATA UNITS on Jerguson Truscale and Trulevel Gages

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Phone Listed Under JERGUSON

[To obtain more data on advertised products see page 424]

FLARE TIP DESIGN—

An Important Factor in Control Of Air Pollution from Refineries

Introducing a special series in PETROLEUM PROCESSING describing improved design of waste gas stacks and flare tips developed by oil company refinery engineering departments.

AN important part of the improvement in the disposal of plant wastes of all kinds from refineries has been the development of more efficient methods for burning gaseous wastes. This has included the development of improved flare tips for both stacks and pits where waste gases are burned.

Unlike some organized phases of the program for better control of the disposal of plant wastes, the improvement of flare tips in each instance has been the work of the individual engineering departments at the refineries. In order to make this data available to refinery operators generally, several companies have cooperated with PETROLEUM PROCESSING by supplying designs and detailed descriptions of their new types of flare tips for different operating conditions. These are to be published. The first in this series, describing a safety type flare stack igniter designed by Humble Oil & Refining Co., in use at its Baytown refinery, appears in the Plant Practices Section of this issue, pg. 397.

Problems beside Smoke

The elimination of smoke is not the only problem encountered in the operation of flare tips, it was brought out in the survey on the subject conducted by PETROLEUM PROCESSING. Safe ignition, safe pilot flames which will not be extinguished in high winds, proper construction materials for long service life—these and other technical matters have confronted refinery combustion engineers in their work on flare tips.

There is apparently no marked preference for either flare stacks or burning pits for the disposal of gaseous wastes, and conditions at the plant and the surrounding neighborhood govern which type is installed. Many companies employ stacks in one form or another. On the other hand, Pure Oil Co. has stated that in general it prefers burning pits where ground space is available. They eliminate the expensive structures which high flares require, are cheaper to maintain, and are less hazardous in the event of liquid carryover.

Selection of alloy metals or ceramic materials for the fabrication of the flare tip has been governed chiefly by the nature and volume of the waste gases to be handled in the specific instance. No companies have found sour gases as such a troublesome factor in the design of the flare tip, but their nature has to be taken into account in the selection of the metal for the tip.

$10 Million Was Spent

It is reported that American industry has spent some $10 million in the past 2½ years on control equipment, analysis of process operations, stack sampling, and other phases of the atmospheric pollution problem. The research is continuing and expenditures for equipment in 1950 are expected to exceed 1949.

So-called "smog" has not been a product of petroleum processing, the record proves. However, the refineries in the Los Angeles area have been working for years to handle properly the burning of refinery waste gases. For example, in a case

Left, before, and right, after, photographs of waste gas burning pits at General Petroleum's Los Angeles refinery presents vivid demonstration of effectiveness of smokeless flaring technique

reported and described in PETROLEUM PROCESSING, March, 1947, pg. 168, the General Petroleum Corp. developed a means for the smokeless burning of its waste gases. The accompanying photographs show General Petroleum's method of flaring gases in a pit before and after the present smokeless technique was adopted.

Mr. Gale L. Adams, the company vice president, told PETROLEUM PROCESSING last month "continuous operation since the installation date has resulted with no complaint or citation for black smoke from the Air Pollution Control people." The plant is located in the Los Angeles Basin area.

Communities Concerned

Pollution of the atmosphere, like that of waterways, has been coming into increasing prominence recently as a problem concerning the petroleum processing and other industries throughout the country.

Just as municipal, state, and federal governments have become more aware of and have enacted legislation covering the disposal of liquid wastes into streams and other bodies of water adjacent to petroleum refineries and other plants, so also have communities concerned themselves with gaseous wastes.

More than a dozen various technical conferences on air pollution have been held the past year. One of the first of these was the Symposium on Air Contamination and Purification sponsored by the American Chemical Society's Division of Industrial and Engineering Chemistry at the meeting in San Francisco, March, 1949.

Stanford Research Institute sponsored the National Symposium on Air Pollution in Pasadena, Calif., in November, 1949, in collaboration with California Institute of Technology, the University of California at Los Angeles, and the University of Southern California.

A series of papers read at the annual meeting of the Industrial Hygiene Foundation and those of the University of Michigan Short Course on Air Pollution, at Ann Harbor, Mich., February 6-8, 1950, were scheduled for publication in the March 12 issue of *Industrial Medicine* or in *Industrial Hygiene Quarterly* later this year.

Federal Conference

The U. S. Dept. of the Interior will sponsor a U. S. technical conference on air pollution in Washington May 3-5, 1950. Participating agencies are: the Bureau of Mines, Public Health Service, Weather Bureau, Bureau of Standards, Chemical Corps, Surgeons General of the U. S., Atomic Energy Commission, and the Dept. of Agriculture.

Anyway you figure it....

You get TWICE the VALUE with...

Clark DUO-STEP Leverage STEAM TRAPS

HERE'S HOW DUO-STEP WORKS:

1. Shows orifice closed.

2. First fulcrum point "cracks" orifice.

3. Second fulcrum point moves valve from orifice.

The amazing new Clark Duo-Step design actually *doubles* the drainage capacity of Clark Steam Traps. This means *double value* anyway you figure it. Now you can use smaller, less expensive traps for larger drainage jobs or get *twice* the drainage from traps you have been using.

Sound good? It is! Better look into Clark Duo-Step *today* and start saving real money on your steam trap requirements.

THE CLARK MANUFACTURING COMPANY
1842 East 38th St., Cleveland 14, Ohio

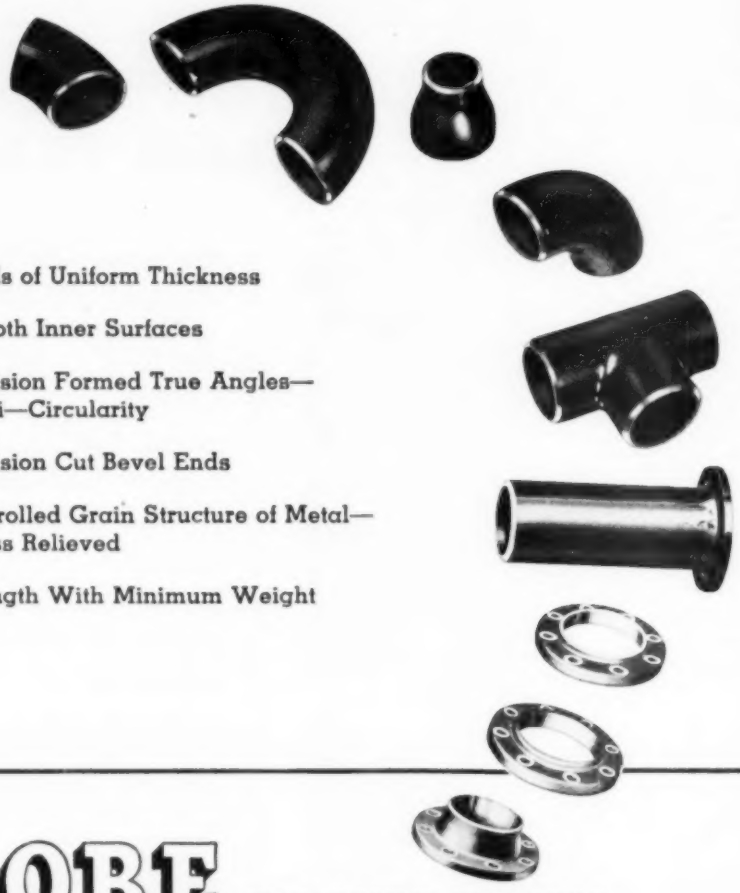
GET THE WHOLE AMAZING STORY, SEND FOR THIS BOOKLET -Today!

Clark DUO-STEP Leverage

Clark FLUID CONTROLS

[To obtain more data on advertised products see page 424]

CONNECT WITH THESE ADVANTAGES IN YOUR PIPING CONNECTIONS . . .



- ★ Walls of Uniform Thickness
- ★ Smooth Inner Surfaces
- ★ Precision Formed True Angles—Radii—Circularity
- ★ Precision Cut Bevel Ends
- ★ Controlled Grain Structure of Metal—Stress Relieved
- ★ Strength With Minimum Weight

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

All of these advantages are yours in Globe Welding Fittings. Globe's metallurgical experience and highly specialized production and processing facilities are utilized beginning with the production of Globe seamless steel tubes and continuing through every step to the finished Globe Welding Fittings.

GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia
St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Glowekd welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

There's plus value in Globe Welding Fittings — send for the catalog.

Ethylene Production by Cracking Of Propane-Ethane Mixtures

By C. K. BUELL and L. J. WEBER
Phillips Petroleum Co., Bartlesville, Okla.

Part 2—Tube Selection and Inspection

Erosion of tube metal by hard carbon particles constitutes the greatest mechanical problem in the operation of the cracking furnace for the production of ethylene from propane-ethane mixtures. As a result of extensive plant tests 18-8 Cr-Ni alloy tubes were selected for positions near the outlet of the cracking coil, while 25-20 Cr-Ni alloy tubes are used where service is less severe.

The welded coil type of construction has proved entirely feasible for this type of operation, since it makes it easy to change the return bends or tubes and provides maximum flexibility with regard to materials which may be employed. Tube life charts, prepared from actual operating data, constitute the basis for setting up a tube replacement program for maximum on-stream service and economy in use of materials.

Part 1, describing the process for ethylene manufacture, appeared in the March issue of *Petroleum Processing*. The complete paper was presented at the Seventy-fifth Anniversary of the Colorado School of Mines, Golden, Colo., Sept. 30-Oct. 1, 1949.

THERE are, even at the present time, few tube alloys ordinarily considered suitable for gas cracking service in the 1500° to 2000° F. temperature range. These are 25-20 Cr.-Ni., 25-12 Cr.-Ni., Inconel, and 27 Cr. Inconel is undesirable both from the standpoint of cost and the possibility of causing undesirable catalytic reactions at cracking temperatures. The 25-12 Cr.-Ni. alloy is not fabricated by the seamless process or welded into tubes having sufficient wall thickness, and 27 Cr., besides having very low elevated temperature creep strength, has undesirable embrittlement characteristics.

One form of embrittlement in 27 Cr. becomes most severe when the metal is operated at a temperature of approximately 885° F.; this embrittlement, however, can be removed by heating to 1100° F. and quickly quenching. A second form of embrittlement results from sigma-phase formation when the alloy is operated at 1200° F. and higher. This type of embrittlement can be successfully removed only by heating for a specified length of time at a temperature above 1500° F. and quickly quenching, a procedure which is not feasible in a gas cracking furnace lined with heavy refractories. The upper temperature use limit of 18-8 Cr.-Ni. alloy for satisfactory oxidation resistance is 1600° F., except for which this alloy is a desirable tube material for gas cracking service. The maximum metal temperature at which 25-20 Cr.-Ni. may be employed without excessive oxidation is 2000° F.

The above considerations, while not the sole factors, determined the selection of 25-20 Cr.-Ni. and 18-8 Cr.-Ni. for the radiant and convection tubes, respectively. Neither alloy was stabilized by the addition of columbium or titanium; however, in the case of the 18-8 tubes, the heat stabilized alloy was used. In unstabilized alloy tubes, chromium carbide precipitation occurs in the temperature range 800° to 1600° F. and the carbide does not resolve until a temperature of around 1800° F. is reached.

It has been found that chromium carbide precipitation is inhibited by the presence of titanium or columbium (in amount 8 to 10 times the carbon content, the latter being usually 0.07%) which have greater affinities for carbon than that exercised by chromium, enabling the carbon to remain distributed uniformly through the grains as columbium or titanium carbide instead of concentrating as chromium carbide at the grain boundaries, thus weakening the alloy structure.

Where grain structure is coarse, there may be sufficient carbon to surround each grain with the precipitated chromium carbide, giving an extremely weak structure. By a treatment called "heat stabilization" it is possible to make the grain structure finer, giving a greater number of grains—so many, in fact, that there is not enough carbon to make sufficient chromium carbide to surround each grain and weaken the alloy structure.

Metal in the radiant section tubes is exposed to free carbon at temperatures in the carburizing range, and for this reason, no benefit could be expected from the use of columbium or titanium stabilized alloys. The stabilizing influence of the columbium or titanium is lost as soon as the ratio of carbon to stabilizer exceeds the values stated above. In actual furnace tests subsequently made with replacement tubes, it was found that the columbium stabilized alloy replacement tubes were in no way superior to the unstabilized alloy for this service, either in metal structure or over-all life.

After a short initial operating period, trouble was encountered in the form of tube leaks caused by erosion of metal from the interior surfaces of tubes in the outlet portions of the cracking coils. Leaks in the tube coils in these units present a problem more serious from the standpoint of loss of production and cost of tubes than as a safety hazard, because process gas released into the furnace combustion space ignites immediately, mingles with the burner flue gas, and passes out through the stack.

Erosion of tubes by hard carbon particles constitutes the greatest single factor in cost of the cracking furnace operation. Acceptance of this condition as an unavoidable result of normal cracking operations has guided the thinking in bringing about changes in the design of and mate-

rials used for tubes, and in procedures of operation. Frequency of carbon cleanouts has a direct bearing on tube life. Premature failure may occur, and often does occur, when tubes become clogged with carbon and hard deposits build up in the return bends.

Data accumulated comparing the maximum service, or run, on a tube in a given position with the average length of service for a large number of tubes in the same position indicate that seldom is the maximum possible life obtained from the tubes. In other words, much greater utilization of the tubes would occur if at all times conditions could be maintained such as those under which the maximum life tube runs occurred. Carbon formation will take place and it may be argued that a clean tube is a better catalyst for promoting carbon growth than is a "coked-up" tube. This is not sufficient reason for operating with heavily carboned tubes, however, because tubes will not coat evenly, the areas subjected to severe erosion will never coat with carbon, and predictions pertaining to tube life have no value. A regular schedule should be followed, depending upon individual operating conditions, for cleaning out the tube coils.

Two methods are used to remove accumulated carbon deposits from the tubes: thermal shocking and controlled internal combustion. Thermal shock carbon removal requires that the feed be shut out for a short time and then quickly reintroduced after the tubes have become heated above normal. Contraction of the tubes as the relatively cold feed is reintroduced causes hard, thick types of carbon deposits to be loosened and carried out through the effluent line to the carbon catcher. Thermal shock carbon removal can be accomplished with but slight interruption to the feed flow, while controlled combustion, which does a more thorough job of tube cleaning, requires several hours. Feed gas is shut out of the coil and burner firing is reduced to a black firebox heat, after which steam is introduced at the coil inlet, together with a small amount of air.

After internal burning of the carbon deposits has been established, the air quantity and burner fuel are adjusted so as to maintain internal burning but to prevent overheating of the tubes. Control is both visual and by analysis of the effluent gas for carbon dioxide content, with the ratio of air to steam flow being gradually increased as the burnout is nearing completion. Progress of the internal burning zone along the tube coil can be clearly seen by difference in redness of the tube metal; likewise, carbon deposits show up clearly as hot spots on the tubes during operation, the carbon insulating the tube metal from the process gas stream and causing the metal to approach combustion gas temperatures. If the oxygen content of the burnout stream is allowed to become too high, the tubes will become overheated, and it is entirely possible to attain higher metal temperatures during a burnout than when on stream.

How 25-20 Cr.-Ni. tubes fail in the cracking region can best be shown graphically (refer to Fig. 7). These curves show the rate at which wear occurs along the tube length, the curve numbers referring to tube position with respect to coil outlet. Service conditions on each tube become more severe as the coil outlet is approached because of increased gas velocity due to thermal and cracking reaction volume expansion, and because of the progressively greater amount of carbon formed.

These data show the third tube from the coil outlet to have an average weight loss of 0.85 lbs. of metal per foot of tube length per 100 hrs.' service for the first 2' on the inlet end. At this rate of wear, it would require only 1650 hrs. to completely wear away the metal in the first 2' of the inlet end of a 25-20 Cr.-Ni. tube in this position. Actually, because of the localization of wear close to the welded joint, a hole would be worn in the tube long before this could happen.

It will be noted that, except in the first 4 to 6' on the upstream ends, fairly uniform wear takes place in the tubes. This enables the operator to make savings by the re-use of a portion of the tube after the inlet end

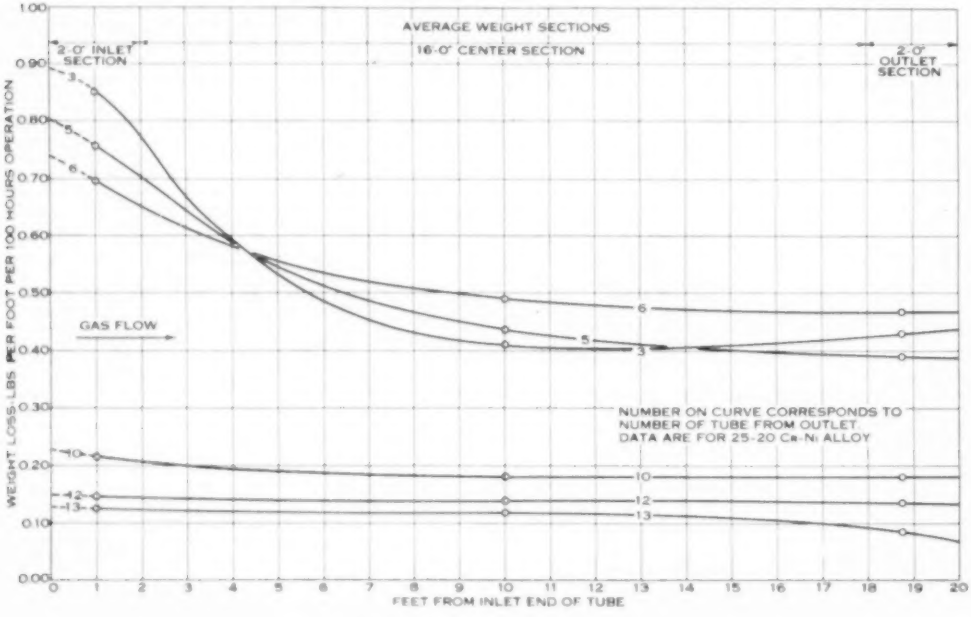

AVERAGE WEIGHT SECTIONS
2-0' INLET SECTION
16-0' CENTER SECTION
2-0' OUTLET SECTION
WEIGHT LOSS-LBS PER FOOT PER 100 HOURS OPERATION
GAS FLOW
NUMBER ON CURVE CORRESPONDS TO NUMBER OF TUBE FROM OUTLET
DATA ARE FOR 25-20 Cr-Ni ALLOY
FEET FROM INLET END OF TUBE

Fig. 7—Distribution of erosion in tubes

has worn out. On tubes higher in the coil, represented by curves numbered 10, 12, and 13, wear is much slower. The wall thicknesses reduce at a nearly uniform rate all along the tube, resulting in a greatly increased utilization of metal. Efficiency of the use of metal in these positions is such that little or no salvage value remains after the tubes have been used once. This study has resulted in the use of tubes with reinforced or thicker ends for the 12 tubes preceding the outlet end of the coil. The reinforced tubes are fabricated by welding a 2′ section of ⅜″ wall tube to an 18′ long section of long section of ¼″ wall tubing.

The search for longer lived tubes and return bends has been carried out by conducting a number of actual tests, trying different alloys and mechanical designs under varying furnace conditions, and keeping accurate records of all data accumulated under these conditions. At one time it was believed that if the interior surfaces of the tubes were polished to mirror smoothness, carbon formed would have less tendency to adhere and accumulate. Accordingly, four 25-20 Cr.-Ni. alloy tubes polished on the interior were installed in one of the cracking furnaces in the roof radiant section where erosion was not severe. After an extended test period, it was concluded that no difference could be discerned in the amount of carbon or hot spots in the polished tubes as compared to unpolished tubes located in similar positions. When inspected after removal from the furnace, the appearance of the interior surfaces of these tubes was identical with the appearance of other tubes which had been subjected to mild erosion.

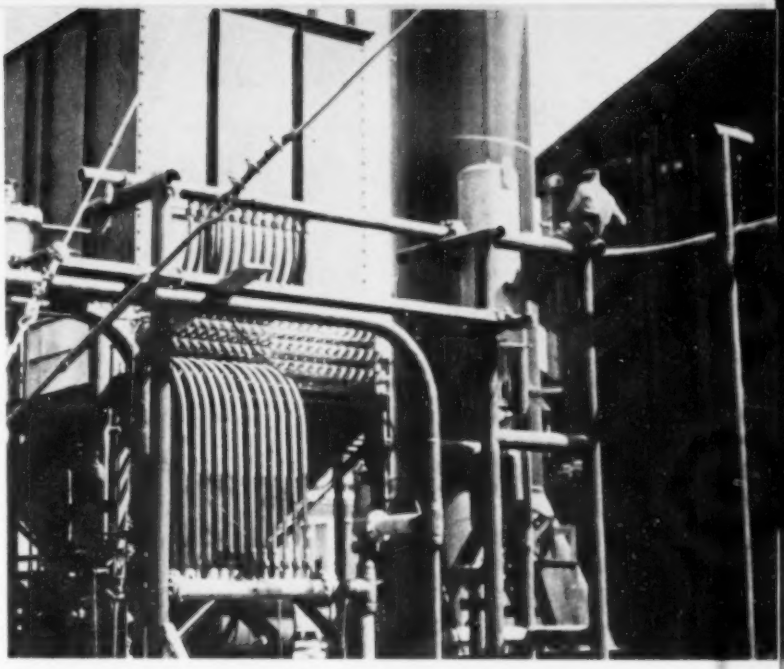
As mentioned previously, although the furnace coils were fabricated from unstabilized alloys, it was deemed advisable in subsequent plant operations to verify the assumption that the addition of a stabilizing element would have no beneficial effect. Tubes of both 25-20 and 18-8 columbium stabilized alloy were installed in the furnaces and their life was compared with unstabilized alloy tubes. There was no measurable difference in the lives of these tubes or the metal structure, and, consequently, in view of the increased cost of the stabilized alloys, the original decision was verified as being correct.

Tests were conducted several years ago to determine whether the type of surface treatment on various alloy steels would have any effect upon the rate of carburization. Surface ground samples were submerged in a carburizing mixture for 100 hrs. and 500 hrs. at temperatures ranging from 1400° F. to as high as 2200° F.

Following this, part of the samples were copper plated, and others were coated with sodium silicate. It was noted that samples coated with sodium silicate experienced only about 10% of the carburizing shown by uncoated samples; contrary to expectations, copper plating increased the rate of carburization.

To test this finding under plant conditions, four 25-20 Cr.-Ni. tubes with specially prepared surfaces were coated inside with 50° Baume' sodium silicate solution and installed in one of the radiant coils. These tubes, located in positions where little erosion was encountered, were removed from the furnace after an extended operating period for examination. No decrease in the rate of carburization in the metal in these tubes was apparent over that found in uncoated tubes.

It is probable that, due to the cyclic nature of furnace operations caused by shutdowns for repairs and tube burning or shocking, with consequent change in dimensions caused by thermal expansion and contraction, the sodium silicate did not remain on the interior surfaces for any appreciable length of time, but rather, spalled off and exposed the alloys to the carburizing effect of the process gas. It had been concluded, even before this test was brought to completion, that it might be rather impractical in the field to adopt a practice of coating the tubes with sodium silicate in view of the many difficulties involved in securing the proper treatment and coating of metal surfaces, in obtaining a coating on the interior of the welds, etc. Also, it has always been evident that a certain amount of carbon would be formed in 25-20 tubes even under optimum conditions.



Air fin cooling unit, furnace stack, and one end of the cracking furnace used for producing ethylene from ethane-propane mixtures

A different approach to the problem of tube erosion involves the possibility of eliminating carbon formation by the use of tube alloys having less catalytic effect on the process gas. It was speculated that the nickel content in the austenitic alloys used might be principally responsible for carbon formation. Consequently, 16 straight chromium alloy tubes were installed in the latter part of the cracking coil of one-half of a furnace to compare the amount of carbon formed in this coil with the amount of carbon formed in the other half of the furnace having austenitic alloy tubes. The alloys selected were 12 Cr., 18 Cr., and 27 Cr., and these were installed in rotation so as to place tubes of each alloy in comparable positions throughout the furnace. Return bends between tubes 55-56, 56-57, 57-58 were of 27 Cr. with the remainder of cast 18-8 Cr.-Ni.

After the tubes had been in service one week, all of the 12 Cr. tubes began to scale, and some scale was noticed on the 18 Cr. tubes at the end of 2 weeks' operation. The 27 Cr. tubes located in positions 50 and 53 were covered with a light scale when they were removed, but there was no scale on any of the other 27 Cr. tubes. After 616 hrs. of operation, a crack appeared in tube 53 at return bend 52-53. This crack was caused from embrittlement of the tube metal near the weld. The types of embrittlement which are found in 27 Cr. have been described previously. Eighteen

other such cracks were repaired in these tubes before removal after a total of 1,845 test operating hours.

Measurements of the tubes after removal, when compared to original measurement, indicated that more creep had occurred in the 12 Cr. than in the 18 Cr. and that the 18 Cr. had a greater creep rate than the 27 Cr. Also, from observation, it was found that the 27 Cr. tubes sagged less between tube supports than did tubes made of the other two alloys. Sagging of the tubes between tube supports was fairly severe for the 12 and 18 Cr. alloys. This information regarding tube creep is contradictory to that found in the literature concerning these alloys, because in laboratory tests under controlled conditions 27 Cr. has always been found to have lower creep strength than either 18 or 12 Cr.

To determine the rate of carbon build-up in the straight chrome iron tubes as compared to the austenitic tubes, visual observations for hot spots were made at regular intervals and a log was maintained on furnace inlet and outlet gas pressures. The rate of pressure drop build-up through the coils is believed to be a more accurate criterion of carbon formation than the visual method. It was concluded from the pressure drop data that slightly less carbon was formed in the radiant coil having the straight chrome tubes than in the coil having the austenitic tubes. This difference in carbon build-up was not considered to be great enough, however, to offset the disadvantages of lower creep strength and embrittlement. It would be necessary in designing a furnace to use any of the straight chrome iron alloys to place the tube supports closer together than when designing for austenitic tubes.

Not much has been said concerning return bend replacement, but the problem has been great enough to require intensive study regarding methods for repair and replacement. Bends cast of 2¼ Cr., 5 Cr., and 9 Cr. alloys were found to have a much shorter life than bends cast from either 25-20 or 18-8 and, further, oxidation proceeds at such a fast rate on straight low chrome iron castings that they cannot be satisfactorily repaired by welding after one run in the furnace.

Return bend castings of Twenty-five-twenty or 18-8 can be satisfactorily built up on the interior surfaces using 5 Cr. alloy welding rod or various hard surfacing rods. Colmonoy No. 6 rod was found to give the best service and most uniform results of any of the hard facing materials tried, especially when it was applied with the electric arc so as to obtain an intermediate alloy zone between base metal and overlay, rather than a sharp change in alloy composition such as would obtain when the rod was applied by the oxy-acetylene torch.

As discussed previously, 18-8 alloy tubes were not used originally in the radiant coils because it was believed that the oxidation rate of the metal would be too high to obtain satisfactory service. When tube replacement became so great on the 25-20 alloy, however, it was decided to make a test installation of 18-8 tubes in the outlet portion of the radiant coil. Wear is caused primarily by erosion, and erosion resistance is usually a function of hardness. It was known that 18-8 alloys have the characteristic of work hardening to a much greater degree than does 25-20 alloy, and it was this consideration which suggested the trial.

Tubes of 25-20 and 18-8 alloys behaved entirely differently in the cracking furnace. Fig. 8, showing tube life averages for both alloys, indicates that in the 10 positions nearest the coil outlet, 18-8 tubes have a longer life than do the 25-20 tubes, with no greater life above these positions. Operating temperature for the tubes is within the embrittling range of 18-8 metal throughout the entire coil, and this property makes the salvage life of 18-8 tubes lower than for 25-20 salvaged tubes. In this test the 18-8 tubes showed slightly greater oxidation than did the 25-20, but for the life of the tube this amount was not considered to detrimental.

Surprisingly enough, the 25-20 tubes sagged considerably more between tube supports than did the 18-8. Weight loss for the 18-8 tubes (with one exception) was less, and while the 25-20 tubes were thin for

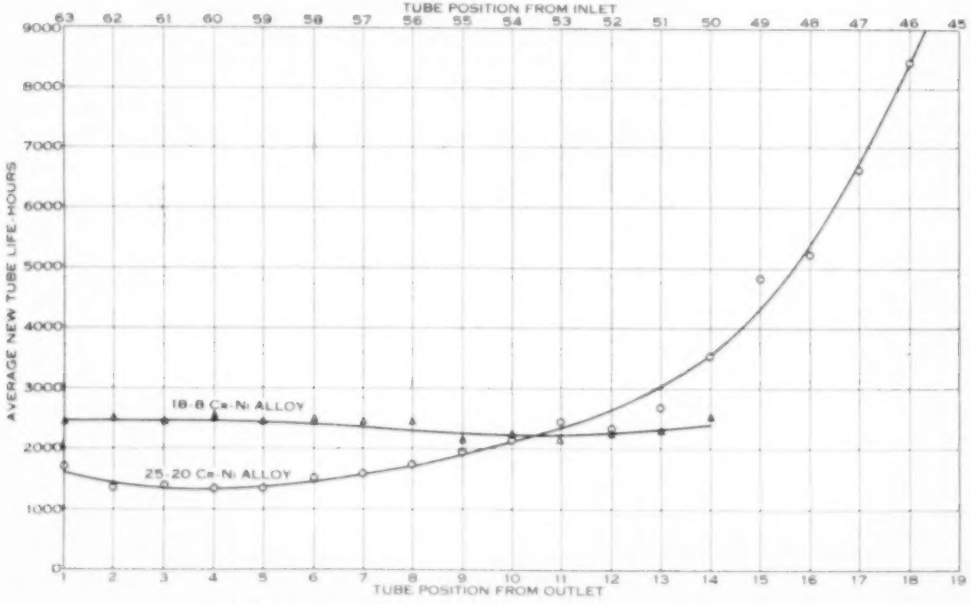


Fig. 8—Average hours of new tube life vs. position in furnace

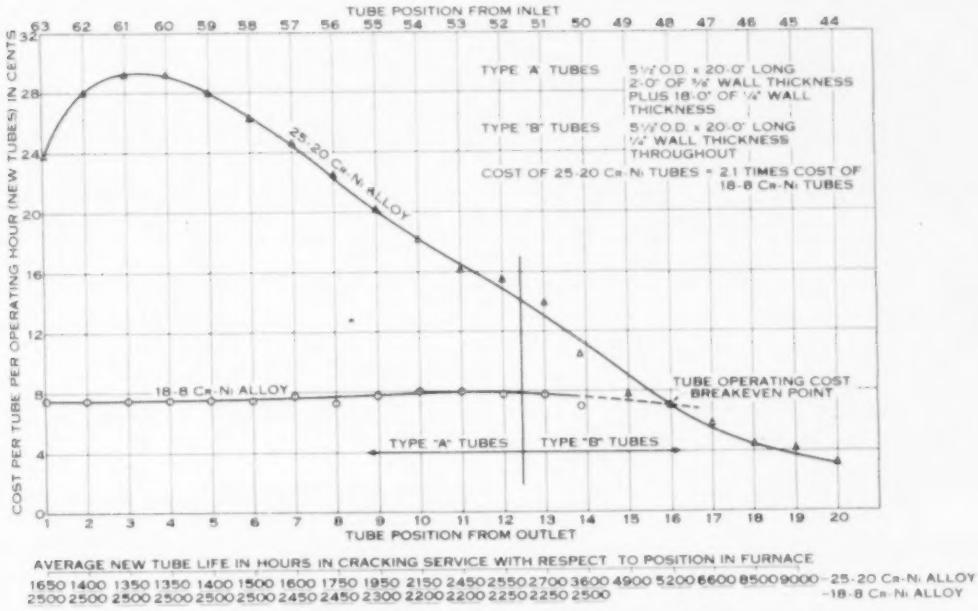

TUBE POSITION FROM INLET
63 62 61 60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44
COST PER TUBE PER OPERATING HOUR (NEW TUBES) IN CENTS
32 28 24 20 16 12 8 4 0
TYPE 'A' TUBES 5½" O.D. x 20'-0" LONG 2'-0" OF ⅜" WALL THICKNESS PLUS 18'-0" OF ¼" WALL THICKNESS
TYPE 'B' TUBES 5½" O.D. x 20'-0" LONG ¼" WALL THICKNESS THROUGHOUT
COST OF 25-20 Cr-Ni TUBES = 2.1 TIMES COST OF 18-8 Cr-Ni TUBES
25-20 Cr-Ni ALLOY
18-8 Cr-Ni ALLOY
TUBE OPERATING COST BREAKEVEN POINT
TYPE "A" TUBES
TYPE "B" TUBES
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
TUBE POSITION FROM OUTLET
AVERAGE NEW TUBE LIFE IN HOURS IN CRACKING SERVICE WITH RESPECT TO POSITION IN FURNACE
1650 1400 1350 1350 1400 1500 1600 1750 1950 2150 2450 2550 2700 3600 4900 5200 6600 8500 9000 – 25-20 Cr-Ni ALLOY
2500 2500 2500 2500 2500 2500 2450 2450 2300 2200 2200 2250 2250 2500 – 18-8 Cr-Ni ALLOY

Fig. 9—Comparison of operating costs for 25-20 Cr-Ni and 18-8 Cr-Ni alloy tubes

a distance of from 2 to 3 ft. from the inlet end, the 18-8 tubes retained almost full wall thickness to within 8 or 10 in. of the inlet end. Table 9 shows the weight and dimensional comparisons for the initial test of 18-8 tubes in the radiant coil section.

Subsequent to the test described above, which was the most significant of any made, tubes which failed in the furnace radiant section were replaced using 18-8 alloy, and after sufficient data were collected a "break-even" chart was constructed to more clearly determine the regions in the cracking coils which should be tubed with 18-8 alloy and those which should remain tubed with 25-20 alloy.

The information developed from this study is shown in Fig. 9. The break-even point for the 18-8 and 25-20 alloy tubes, calculated on the basis of life and cost of each alloy, was found to be at position 48 as shown on the graph. Present tube replacements are made on the basis of these figures; in other words, tubes in any position below 48 in the furnace are replaced with 25-20 alloy, while 18-8 alloy is used in all tube positions from 48 to the coil outlet.

This curve shows graphically how great a saving is effected by using the 18-8 tubes; and, since the break-even point is nearly out of the zone where tubes must be replaced, very few 25-20 tubes are used. Over-all service of the 18-8 tubes has been greater, more uniform, and much less expensive than that of the 25-20 tubes. The average life of 18-8 tubes in the positions where they are used is essentially the same from the break-even point to the coil outlet, making it feasible and desirable to replace tubes by groups according to a planned shutdown schedule.

Using a maintenance crew familiar with these furnaces, it is possible to remove and re-install 14 tubes, 7 in each half, in an 8-hr. working day. The maintenance program operates in the following manner: The engineer assigned to the furnace keeps weekly records on a tube life chart. Each week the vertical bars representing individual tubes in the furnace are lengthened a certain amount, indicating one week's additional service on each tube. When these tube service life bars approach the average expected life curve, the engineer makes plans for a scheduled shutdown, at which time all tubes which have been in the cracking region for the prescribed length of time are removed and new tubes are installed.

If a tube failure occurs prior to the anticipated shutdown time, such as occasionally happens due to a faulty weld, unusual carbon deposits or operating conditions, the failed tube is replaced with a salvaged tube so that new material is not added to the coil until the time of the general scheduled shutdown for tube replacement. This procedure has effected appreciable savings in down-time and in furnace operating expense.

TABLE 9—Comparison of 18-8 and 25-20 Tubes

Tube No.	Mat'l.	Time Hrs.	Tube Wt. Lbs.(1)	Wall Thickness Inlet End(2)				Wall Thickness Outlet End(2)			
59	25-20	1250	268	.095	Hole	.100	.235	.250	.260	.240	.230
60	18-88	1250	277	.200	.230	.240	.205	.285	.260	.230	.240
61	25-20	1250	260	.080	Hole	.120	.250	.240	.230	.220	.185
62	18-88	1250	276	.225	.205	.200	.245	.250	.245	.240	.250
61	18-88	1250	270	.235	.200	.185	.215	.235	.245	.260	.250
62	25-20	1250	278	.260	.110	Hole	.085	.235	.245	.250	.256

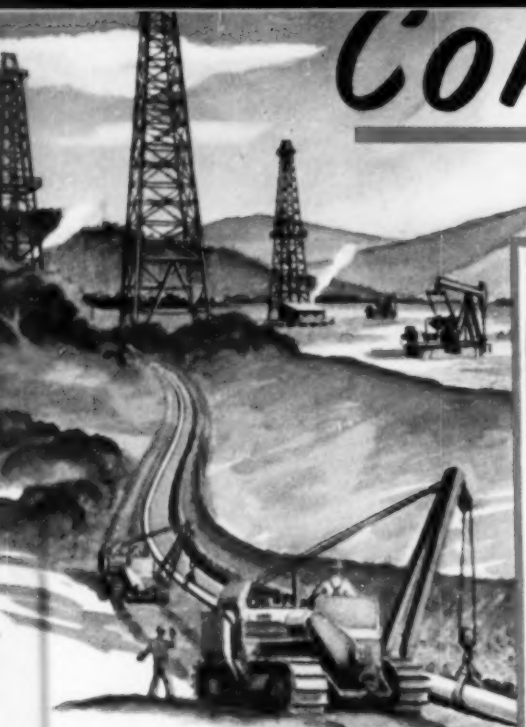
(1) Original weight of both the 25-20 and 18-88 tubes was 280.4 lbs (±5%).
(2) Measurements were made 90° apart on the circumference and 4½ in. from the ends of the tubes.

Acknowledgments

The authors thank Phillips Petroleum Co. for permission to publish this paper, and wish to acknowledge the assistance of J. C. Huddleston in connection with the preparation of the charts presented.

The paper "Ethylene Production by Thermal Cracking of Propane-Ethane Mixtures" was published in the Quarterly of the Colorado School of Mines, Vol. 45, No. 2A, 1950.

Continental-



GATHERING OF OIL AND GAS

DEHYDRATION

NATURAL GASOLINE

THE CONTINENTAL SUPPLY COMPANY, General Offices: DALLAS, TEXAS

The Continental Supply Company, Limited, 216 Lancaster Building, Calgary, Alberta

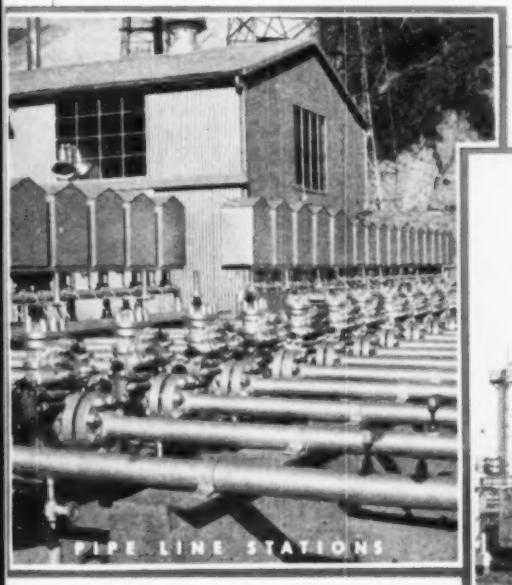
Export Division: The Continental Supply Co., Inc., 30 Rockefeller Plaza, New York, N. Y.

All the Way!

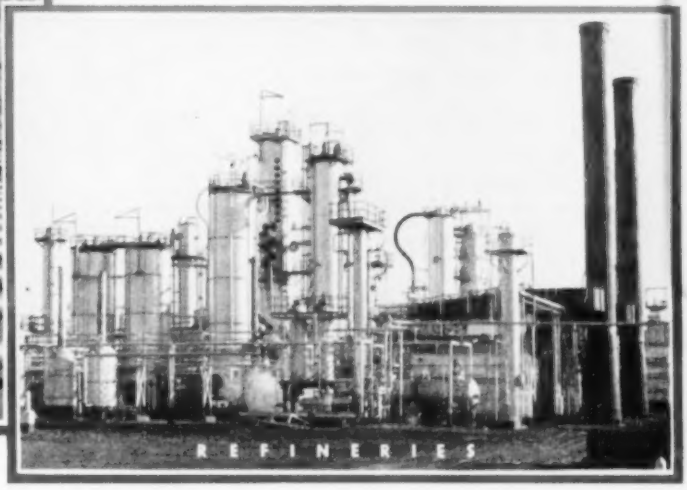
DRILLING—PRODUCTION—PIPE LINE—PROCESSING

THE GREEN TRIANGLE *Serving the Oil and Gas Industries*

For rig or refinery . . . for pipe line or gas plant . . . or for any important operation in the oil or gas industries, Continental is on hand to furnish proper and dependable equipment and supplies. With 72 strategically located Continental stores and offices at your command, you're assured of service second-to-none . . . *proven* "Green Triangle" Service—where and when needed.



PIPE LINE STATIONS



REFINERIES

CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

Representatives: ARGENTINA • BOLIVIA • BRAZIL • CHILE • COLOMBIA • ENGLAND • ECUADOR • PERU • TRINIDAD • URUGUAY • VENEZUELA

"Information Please" Session Will Highlight NGAA Meeting

THE traditional "Information Please" session of questions and answers on processing, production and operating trends in the natural gasoline and cycling industries will again highlight the annual meeting of the Natural Gasoline Assn. of America.

This year's meeting, the 29th annual one, will be held at the Texas Hotel, Ft. Worth, Texas, April 24, 25 and 26. The "Information Please" session is the concluding one on the program, and is scheduled for 9:30 a.m. in the hotel's Crystal Ballroom on Wednesday, April 26.

James E. Pew, Sun Oil Co., Philadelphia, president of NGAA, will open the convention Monday afternoon, April 24, according to William F. Lowe, secretary. The technical session that afternoon will include reports on new and revised LPG test methods, the NGAA-sponsored project to check the accuracy of low temperature fractional analysis of liquid hydrocarbon mixtures, and the cooperative research project on corrosion in gas-condensate wells. Also included will be a paper on the use of bubble valves instead of bubble caps in contact towers.

Tuesday's morning session will include three papers (on centrifugal compressors, training, and marketing of LPG), and will be climaxed with the presentation of the 1950 Hanlon Award for distinguished service to the natutral gasoline and cycling industries. The afternoon session will include two general-interest talks and a technical paper on the underground storage of LPG.

The complete tentative program for the 3-day meeting is printed below. Chairman of the program committee is John F. Lynch, La Gloria Corp., Corpus Christi.

MONDAY, APRIL 24

Afternoon Session

Modifications in LPG Test Methods, by H. A. Montgomery, Warren Petroleum Corp., Houston, chairman of the NGAA Technical Committee. (Announcing revisions in NGAA test methods for liquefied petroleum gases).

The Accuracy of Low Temperature Fractional Analysis of Liquid Hydrocarbon Mixtures, by A. J. Miller, Phillips Petroleum Co., Bartlesville, Okla., chairman of the NGAA Fractional Analysis Committee. (A report on results obtained in an NGAA-sponsored project in which 56 laboratories of 34 oil companies and six commercial laboratories analyzed prepared liquid samples whose exact composition was known only to the blenders.)

Cures for Corrosion in Gas-Condensate Wells, by W. H. Stewart, Sun Oil Co., Beaumont, Texas, chairman of the NGAA Corrosion Research Project committee. (The annual report to the industry on the work of this cooperative research program, now in its sixth year, and presenting specific recommendations for alleviating this destructive corrosion.)

Vapor Pressure of Liquefied Petroleum Gases, by Joe F. Wood, Skelly Oil Co., Pawhuska, Okla. (A new bomb and a revised method for making these determinations.)

Bubble Valves for Contact Towers, by I. Earl Nutter, General Supt., Panoma Corp., Amarillo, Texas. (Replacing bubble caps with valves to give increased efficiency. Demonstration with color movies.)

TUESDAY, APRIL 25

Morning Session

Centrifugal Compressors, by E. A. Koenig, General Supt. Texas Eastern Transmission Corp., Shreveport, La. (The practical application of large capacity centrifugal compressors to gas transmission.)

Industry's Training Job, by Willard G. Wiegel, Personnel Director, Lone Star Gas Co., Dallas. (The responsibility of industry is not confined to job training, but extends into the field of psychology.)

The Marketing of Liquefied Petroleum Gases, by Kenneth Rugh, Manager, Philgas Div., Phillips Petroleum Co., Bartlesville. (The story of broadening markets and some predictions for the future.)

Presentation of the 1950 Hanlon Award for distinguished service to the Natural Gasoline and Cycling industries.

Hanlon Award Address by the recipient of the Award, whose name will be announced at the time of presentation.

Afternoon Session

Cooperation Between the Oil Industry and Regulatory Bodies with Respect to the Marketing of Residue Gas, by Paul Kaiser, President, El Paso Natural Gas Co., El Paso, Texas. (Conservation can best be served by a better understanding of the objectives of both sides in this pressing problem.)

Underground Storage of Liquefied Petroleum Gases, by C. R. Williams, Vice President, and C. B. Johnson, Jr., Chief Engineer, The Chicago Corp., Corpus Christi. (The detailed story of the successful storage of LPG—in liqud phase—in a depleted underground reservoir.)

Realism in Air Preparedness, by Lloyd L. Turner, Director of Public Relations, Consolidated Vultee Aircraft Corp., Ft. Worth. (A frank discussion of the technical and financial problems in manufacturing aircraft suitable for the atomic age, illustrated with a late sound movie on the B-36.)

Evening Session

Chuck Wagon dinner and entertainment, sponsored by the Natural Gasoline Supply Men's Assn.

WEDNESDAY, APRIL 26

Morning Session

Information Please, a forum for executives and operating men in which they can question leading authorities on processing, production and operating trends and discuss other matters of interest to the industry. The session is continuous throughout the morning, with written questions being directed to a Panel of Experts through a question screening committee and moderator.

Panel of Experts:

California Operations—J. B. Taylor, Signal Oil & Gas Co., Los Angeles, and President, California Natural Gasoline Assn.

Engines and Compressors—T. O. Kuivinen, Cooper-Bessemer Corp., Mt. Vernon, Ohio.

Field and Plant Operation—W. S. McAllister, Warren Petroleum Corp., Gladewater, Texas.

General Operations—H. R. Legatski, Phillips Petroleum Co., Bartlesville, Okla.

Industrial Relations—M. V. Cousins, United Gas Co., Shreveport.

Marketing—Mark Patton, Hurley Gasoline Co., Tulsa.

Processing—Will Swerdloff, Magnolia Petroleum Corp., Dallas.

Product Pipe Lines—S. S. Smith, Shell Oil Co., New York.

Refining—Glenn O. Wynn, Mid-Continent Petroleum Corp., Tulsa.

Reservoir Engineering—D. L. Katz, University of Michigan, Ann Arbor, Mich.

Safety—D. A. Klemme, Stanolind Oil & Gas Co., Tulsa.

State Regulations—W. J. Murray, Chairman, Texas Railroad Commission, Austin.

Moderator:

J. H. Dunn, President, Shamrock Oil and Gas Co., Amarillo, Texas.

Question Screening Committee:

Charles A. Swartz, Caska Corp., Tyler, Texas, Chairman.

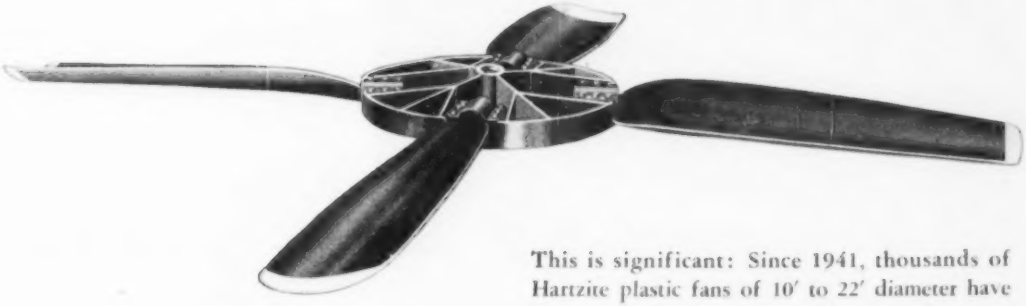
J. R. Bailey, Continental Oil Co., Ponca City, Okla.

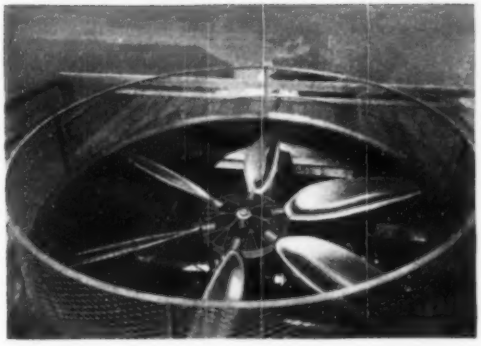
G. E. Canaday, Skelly Oil Co., Tulsa.

E. J. Mills, Barnsdall Oil Co., Benton, La.

Paul Bagley, Lone Star Producing Co., Dallas.

Why are Oil Refiners standardizing On Hartzite Cooling Tower Fans?





This is significant: Since 1941, thousands of Hartzite plastic fans of 10′ to 22′ diameter have been installed in oil refineries, and *not one* has failed for any cause except obvious abuse.

No wonder oil refiners are standardizing on the Hartzell cooling tower fan!

The Hartzite blade is not only extremely resistant to vibration and shock damage, but also practically impervious to weathering and the acids and alkalies found in oil refining. It stands up unusually well against abrasion.

Where the Hartzell cooling tower fan has been tried it has been specified regularly on following towers by the same user. Practically all the reliable cooling tower builders specify it, many of them exclusively.

This fan solves one of the most irritating and costly problems of the industry. We invite *you* to clip and mail the coupon below for full information, or drop us a line. And remember — new tower or replacement, *insist on Hartzell* fans, 3′ to 22′ diameter.

CLIP! and mail now

SEND Hartzell Cooling Tower Fan information to me.

Name_____

Company_____

Street & No._____

City & State_____

HARTZELL

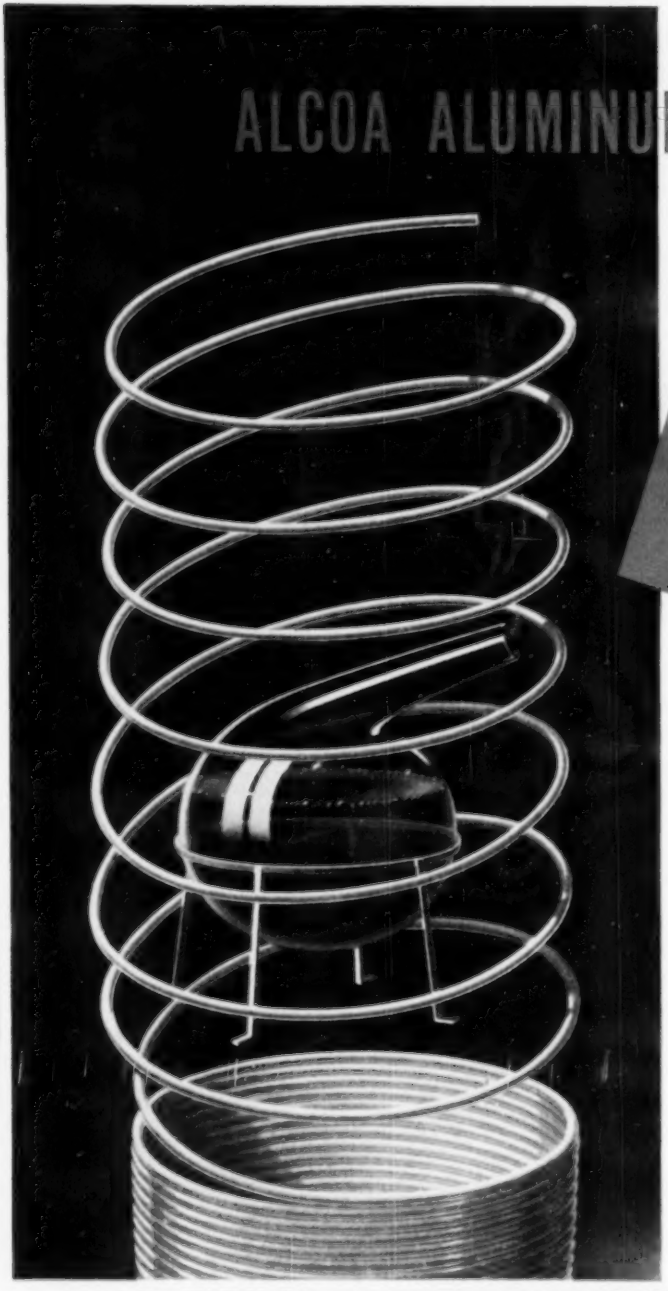
PROPELLER FAN CO.

DIV. OF CASTLE HILLS CORP.

PIQUA, DEPT. K OHIO

PROPELLER-TYPE FANS AND BLOWERS—ROOF VENTILATORS—UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES

ALCOA ALUMINUM TUBING



resists sulfurous fumes...

CUTS TUBING COST 40%

Save 40% or more on tubing, and get improved performance to boot. Easily formed and flared, Alcoa Aluminum Tubing installs fast. Resists corrosion by H_2S and other sulfurous fumes. Comes in lengths up to 400 feet. Ideal for instrument, fuel and air lines. Aluminum fittings available from several manufacturers.

Your nearby Alcoa Distributor has complete tubing stocks, including special alloys for use where vibration is severe. Call him or your local Alcoa sales office today for samples and prices. ALUMINUM COMPANY OF AMERICA, 2168D Gulf Building, Pittsburgh 19, Penna.

For local source of supply of Alcoa Tubing and other Alcoa products, look under "Aluminum" in your classified telephone directory.

ALCOA

ALCOA *Aluminum* TUBING

INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

Plant Practices

Practical Tips and Ideas for Improving Operations

No Open Flames or Sparks Produced By Safe Flare Stack Ignition Device

By W. A. McELHANNON, Designing Engineer, and O. L. CLEVENGER, Civil Engineer, Humble Oil & Refining Co., Baytown, Texas

ONE of the problems which has confronted the petroleum processing industry for many years has been the disposal of waste gases. Probably the method most widely used for disposing of these gases is by burning at the top of tall stacks. This method presents the interesting yet perplexing problem of lighting and keeping lighted the pilot flame on elevated flare stacks.

Many types of lighters have been tried, ranging from elaborate sparking devices and gas-fired ladders to raising burning torches to the stack tops by cables. In some instances tracer bullets and flares have been shot through the gas at the top of the stacks. These methods have met with varying degrees of success, none having been proved entirely satisfactory.

Recently a distinctly different method was developed and put into operation at the Baytown refinery of Humble Oil & Refining Co. This method comprises a 1-in. continuous pilot gas line, running from the ground to the top of the stack, and a 2-in. pipe, approximately 10 ft. long located adjacent the 1-in. pilot line at the top of the stack. The 2-in. line is perforated at its lower end and is connected at that end to a $\frac{3}{8}$-in. copper tubing extending to a needle valve and gas supply line at the base of the stack.

Inside the lower end of the 2-in. pipe is an electrical heating element with leads extending to a transformer and an explosion proof switch at the base of the stack. The general ar-

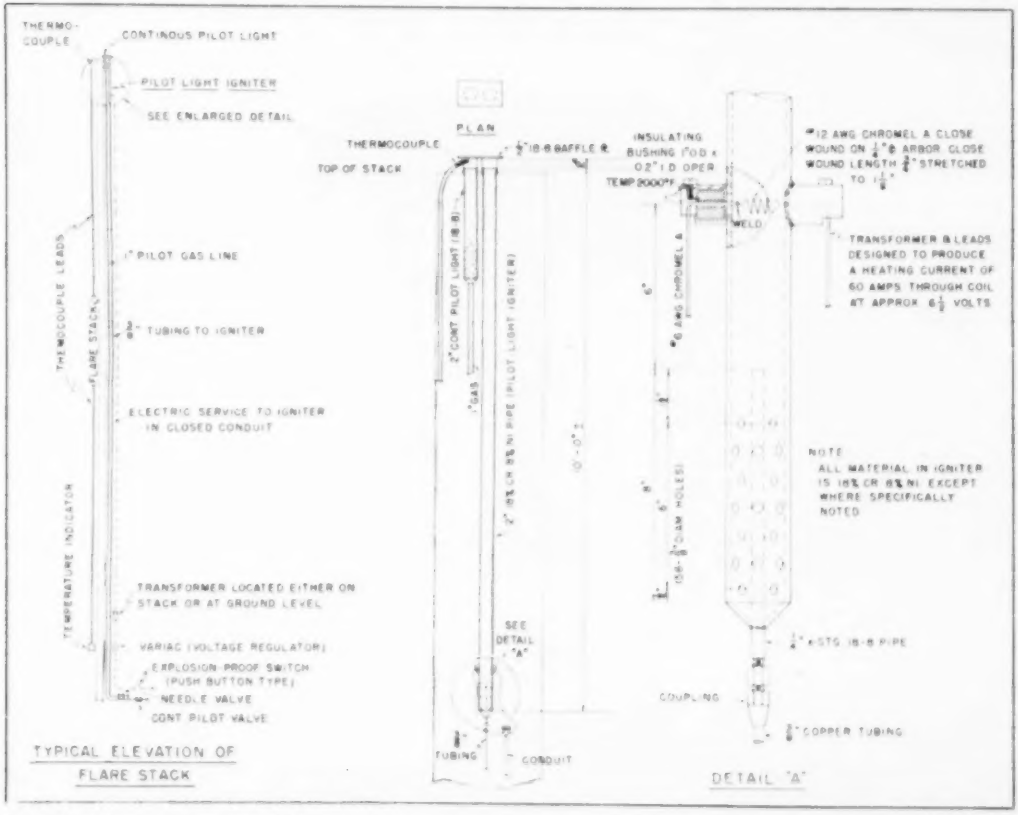
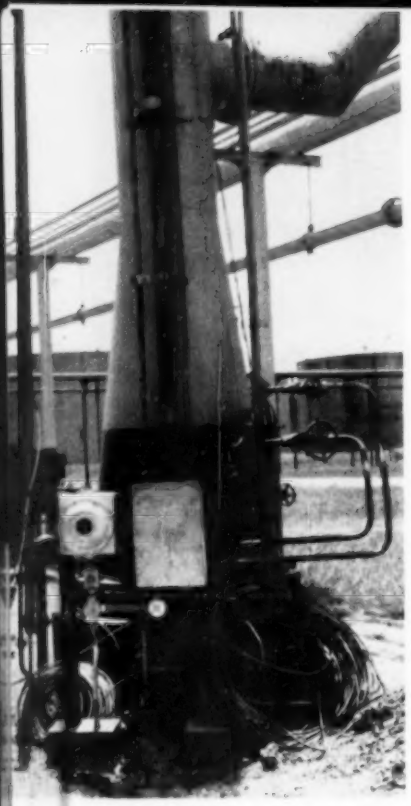

THERMO-COUPLE
CONTINOUS PILOT LIGHT
PILOT LIGHT IGNITER
SEE ENLARGED DETAIL
THERMOCOUPLE LEADS
FLARE STACK
1" PILOT GAS LINE
3/8" TUBING TO IGNITER
ELECTRIC SERVICE TO IGNITER IN CLOSED CONDUIT
TEMPERATURE INDICATOR
TRANSFORMER LOCATED EITHER ON STACK OR AT GROUND LEVEL
VARIAC (VOLTAGE REGULATOR)
EXPLOSION PROOF SWITCH (PUSH BUTTON TYPE)
NEEDLE VALVE
CONT PILOT VALVE
TYPICAL ELEVATION OF FLARE STACK
PLAN
THERMOCOUPLE
TOP OF STACK
1/2" 18-8 BAFFLE R.
INSULATING BUSHING (OD x 0.2" I.D OPER TEMP 2000°F
#12 AWG CHROMEL A CLOSE WOUND ON 1/4" Ø ARBOR CLOSE WOUND LENGTH 2" STRETCHED TO 1 1/8"
WELD
TRANSFORMER & LEADS DESIGNED TO PRODUCE A HEATING CURRENT OF 60 AMPS THROUGH COIL AT APPROX 6 1/2 VOLTS
#8 AWG CHROMEL A
3" CONT PILOT LIGHT (18-8)
GAS
2" (18% CR 8% NI PIPE (PILOT LIGHT IGNITER)
(24-3/8" DIAM HOLES)
NOTE
ALL MATERIAL IN IGNITER IS 18% CR 8% NI EXCEPT WHERE SPECIFICALLY NOTED
SEE DETAIL "A"
1/4" x STS 18-8 PIPE
COUPLING
3/8" COPPER TUBING
TUBING
CONDUIT
DETAIL "A"

Fig. 1—General arrangement and details of waste gas flare igniter developed and used at Humble's Baytown refinery



Humble's flare igniter assembled at base of stack for testing before erection by steeplejacks. Note 10-ft. long, 2-in. pipe with perforated end at left of stack

rangement and details of this igniter are as shown in Fig. 1.

To ignite the pilot the switch is closed at the base of the stacks which energizes the heating element with a low voltage current. This current is so regulated that the element reaches a maximum temperature of approximately 1800° F. in 20 seconds. When the element has become heated a small amount of natural gas is introduced into the lower end of the 2-in. pipe through the ¼-in. tubing and is mixed with air which enters through the perforations. On contact with the heated element this combustible mixture is ignited and the flame travels through the 2-in. pipe to the top of the stack where it ignites gas coming from the continuous pilot. This method has been in continuous use for approximately one and one-half years on stacks ranging in height from 200 to 300 ft.

Advantageous features of this igniter are: 1) since no open flames or sparks are required at the base of the stacks, it is not necessary to obtain a gas test to see if a combustible mixture of hydro-carbons is present at the base of the stack before operating the ignition device; 2) there is no danger of an explosion due to improper mixture of gas and air in the ignition line, as would be the case if a combustible mixture of air and gas were introduced at the base of the stack; and 3) the heat source for ignition is a low voltage heating element which avoids the difficulties of insulation encountered with spark ignition devices.

On clear days it is impossible to see if the pilot light at the top of the stack is burning. To overcome this dificulty a thermocouple has been placed at the top of all stacks with leads extending to temperature indicating instruments located at the base of the stacks or in the control houses serving the units in which the flare stacks are located. Proper adjustment of the gas to the continuous pilot can be obtained by observation of temperature indicator. It has been found from practice that a properly adjusted pilot light will result in an indicated temperature of approximately 600° F. on this instrument.

Further refinements could be added consisting of solenoid switches and valves that would automatically relight the pilot if it should be accidentally extinguished. So far it has not been advantageous to add these further refinements on insallations now in use.

The design and construction of this ignition device is covered by patent applications owned by Humble Oil & Refining Co.

Worn Heat Exchanger Baffles Repaired With Hardwood Gives Tight-fitting Seal

THE channel and the floating heads on cooling exchangers used at the Bayonne, New Jersey, refinery of Tide Water Associated Oil Co. are in constant contact with sea water as the coolant, the corrosive nature of which increases as the temperature rises. The corrosion is electrolytic in its action on the ferrous metal baffles where they come in contact with the non-ferrous or bronze tube sheets.

Past procedure has been to weld in new steel baffles on steel heads, and to repair cast iron baffles by building up with cast lead. Wooden repairs have been tried, but the prob-

Tide Water repairs heat exchanger baffles with hardwood sealed into place with molten lead to obtain long-wearing replacements

lem was to obtain a tight seal to the remaining part of the iron baffle.

The present method utilizes wood but requires no accurate fitting, gives a tight seal, and saves considerable working time. The worn baffle is cut down to a good, solid metal, the scale is cleaned off, and a row of holes drilled or cut along the edge. Then a hardwood baffle is fitted into place, as illustrated in the photograph.

One edge of the wooden replacement is cut down to the thickness of the original metal baffle, so as to contact the tube sheet between rows of tubes. The other, or lower, edge is grooved to fit over the edge of the cut back metal baffle. Holes are bored to coincide with those in the metal. The hole ends are sealed with clay, as are all edges and seams. At each end of the upper edge a pouring gate is constructed. Molten lead is poured in, filling all voids between the metal baffle and the wooden repair, thus making a pressure tight joint, and providing a baffle edge which it has been found greatly outlasts the metal.

Kendall's peep-hole defroster

Material Handling Trays with "Ears" Increase Efficiency of Truck Operator

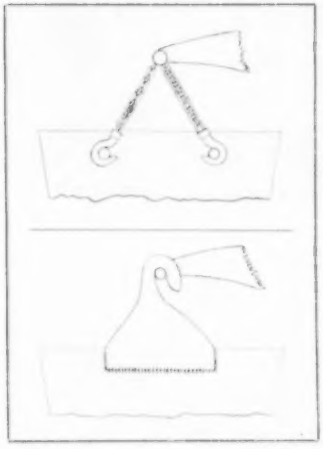


Fig. 2 — Above, conventional chain hook-up for "Load-Lugger" trays. Below, improved method using solid metal "ears"

NORMALLY, the use of a "Load-Lugger" type of material-handling truck involves considerable time for picking up the large metal load trays. The driver must adjust his truck arm to the proper level, and then place each of the four hooks securely in position on the pins along each side of the tray.

By substituting an "ear" on each side of the tray for the pair of pins, and eliminating the hook and chain assemblies completely, as shown in Fig. 2, considerable time has been saved in such operations at the East Chicago refinery of Cities Service Oil Co. The driver simply maneuvers his truck into position so that the arm is underneath the ears. Then he lifts his load and drives away without leaving the cab of his truck.

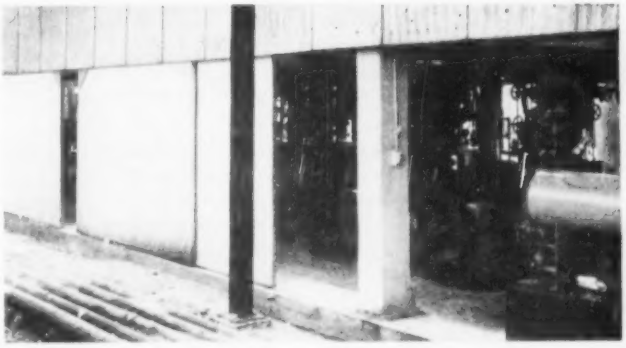
The ears are made of heavy plate and are welded to the tray sides at the exact center so that the loaded tray will remain level while being transported.

Defroster Clears Opening In Wax Filter Peep-hole

BECAUSE of the extremely low temperatures in a rotary filter for removing waxes from oil, a film of water will be deposited by condensation on the outside surface of the glass peep-hole. This film of moisture frequently becomes a sheet of ice which prevents visual inspection of the scraper action and the rotation of the filter element.

To overcome the frosting of the window, Kendall Refining Co. at Bradford, Penna., employs the principle of automobile windshield defrosting. A copper tube is connected to the plant air supply and led to the window of the filter where the open end is fashioned to deliver a flat stream of air directly against the surface of the glass. Because the plant instrument air has been completely dried, it quickly disperses the film of moisture. Except for an occasional wiping to remove dust, the window remains clear and provides visual inspection instantly.

Sliding Doors—Easier Maintenance



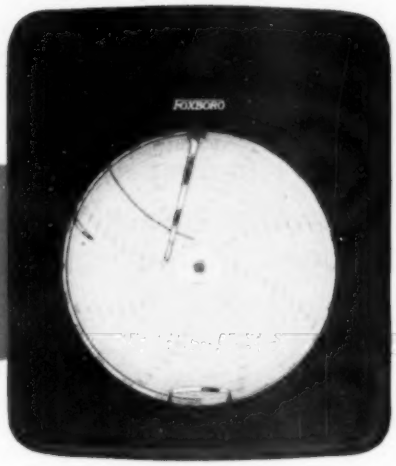
Greater accessibility to equipment to be repaired soon paid for the higher initial cost of a sliding door installation on a pumphouse at the Paulsboro, N. J., refinery of Socony-Vacuum Oil Co., Inc. The photograph shows such doors on one wall of a typical pumphouse at Paulsboro.

In general, sliding doors are placed on the east, west, and north sides of the building. The south side is left completely open. This type of construction, using curtain wall design, is slightly more expensive than permanent walls, but it provides for far simpler maintenance on pumphouse equipment.

WHAT! *no gears... no cables... no fast-moving parts?*

NOT with this electronic potentiometer

. . . because it has NO SLIDEWIRE



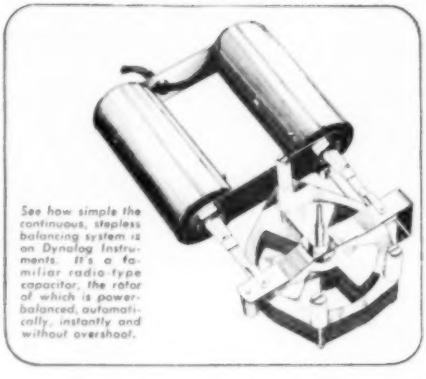
The unique balancing device of Dynalog* Electronic Instruments employs a variable capacitor instead of a slidewire. It is so basically simple that it has only 6 moving parts . . . and only movements of small magnitude are involved. There's nothing to clean, lubricate, adjust, take up or replace. No moving contacts to wear or corrode. Neither dirt, shock, vibration nor ambient temperature can affect its accuracy.

Dynalog balancing is not only continuous but *completely* stepless . . . with sensitivity unlimited by the turn-to-turn steps of slidewire winding. It is so fast that pen or pointer moves full scale to complete balance in as little as 1 second (3 seconds standard).

Dynalog Instruments are available for the measurement and control of temperature (with thermocouples or resistance bulbs), humidity, pressure, flow, force, etc. Complete details in Bulletin 427. Write **The Foxboro Company, 246 Neponset Ave., Foxboro, Mass., U. S. A.**

*Reg. U. S. Pat. Off.

FOXBORO
Reg. U.S. Pat. Off.



See how simple the continuous, stepless balancing system is on Dynalog Instruments. It's a familiar radio-type capacitor, the rotor of which is power-balanced, automatically, instantly and without overshoot.

OTHER DYNALOG FEATURES

- **SENSITIVITY** . . . *one ten-thousandth of scale (1/100 of 1%)*
- **SPEED** . . . *full scale to complete balance in as little as 1 second (3 seconds standard)*
- **ACCURACY** . . . *1/400 or 1/4 of 1% of scale • No galvanometer • No batteries to standardize • No maintenance except occasional replacement of standard radio tubes • No knowledge of electronics needed*

DYNALOG ELECTRONIC INSTRUMENTS

Refinery Valve Design Reduces Sticking at Coking Conditions

REFINERY VALVES, especially those handling petroleum hydrocarbons under cracking conditions, tend to coke up and become difficult to operate. A gate valve designed to overcome this problem is illustrated in Fig. 1.

The gate assembly comprises two parts 11 and 12 which are urged apart and in abutment with the seat elements by coil springs 13. It includes a seal ring 14. Conventional actuating mechanism operates the gate up and down in the valve body.

To prevent coking when handling organic fluids at coking temperatures, a cylindrical member 21, with a removable bottom head 24, is threaded to the valve body. This provides a chamber 21a to receive the gate when it is shifted from the open position shown in Fig. 1 to a lowered position with the upper portion of the gate closing the valve. The size of the chamber 21a is such that any coke formation will settle to the bottom and not interfere with the proper closing of the valve.

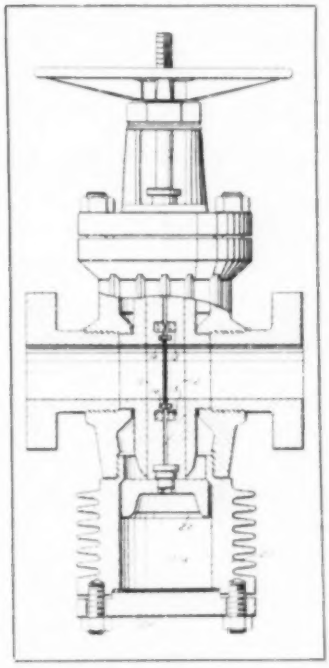


Fig. 1—Refinery valve designed to handle fluids at coking temperatures without becoming coked up (U. S. 2,496,452)

It is necessary to close off substantially communication of chamber 21a with the main passageway of the valve, otherwise line fluid will circulate through it and form additional unwanted coke deposits. This is accomplished by the false partition 22 which moves like a piston in chamber 21a with the normal movement of the gate. Partition 22 preferably is made of refractory material, asbestos, fire clay, or the like. It should have a loose, sloppy fit—a clearance in the range of 0.025 in., for example.

In operation: when the gate is open, partition 22 seals off chamber 21a from line fluid. The close fit between seat members and valve body and between seat members and valve gate provides a relatively quiet zone of fluid in the main portion of the valve body, just surrounding the passageway. Thus a body of fluid is trapped in a position where there is very little addition of heat to the fluid. There is a constant dissipation of heat through the cooling fins on the valve body and on the chamber 21a.

U. S. 2,496,452, issued Feb. 7, 1950, to Robert Eichenberg and Forrest Gober, assignors to McEvoy Co., Houston.

High Efficiency in Contacting Produced by New Bubble Cap

HIGH VAPOR-LIQUID contacting efficiency in fractionating towers can be obtained by revising the design of the bubble caps and incorporating an arrangement of baffle plates between the traps, it is claimed. The drawings in Fig. 2 show one such improved tray unit.

It consists of a set of paired plates 12 and 14. Similar units are equally spaced throughout the height of the tower. The space between tray units and the distance between plates in each pair depends upon the type of fluids undergoing fractionation. The plates are shown as extending only partly across the tower, spaces 22 and 24 functioning as downcomers. Lower plate 12 contains nozzles or jets 16; upper plate 14 is fitted with a number of short tubes or risers 18 immediately above which are located baffles 20.

Risers 18 project sufficiently above plate 14 to prevent any substantial quantity of liquid from running down through the openings. These risers are similar to the throats of Venturi tubes. Particularly when high liquid flows are desired, they may be shaped, as in a Venturi, to increase the ratio of liquid to vapor carried through the riser.

The lower nozzles 16, by being inserted in the risers 18, provides a Venturi-like device. Thus vapors passing up through nozzles 16 become intimately mixed with liquids which flow into the space between plates 12 and 14 from the tray unit above.

U. S. 2,497,136, issued Feb. 14, 1950, to John A. Patterson, assignor to Standard Oil Development Co.

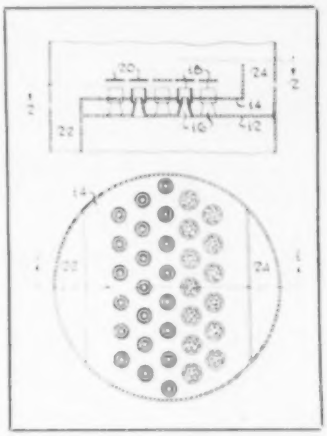


Fig. 2—Plan and elevation sections of an improved vapor-liquid contacting tray unit for fractionators (U. S. 2,497,136)

Patents Issued in February

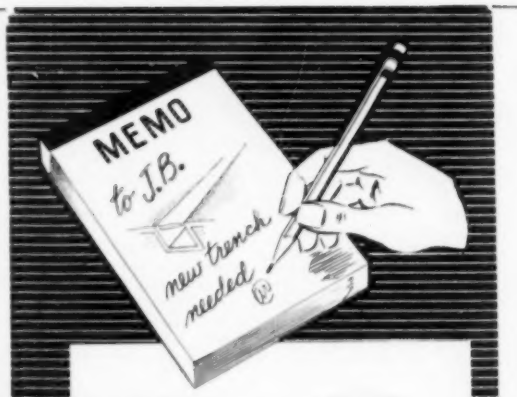
The following classified listing covers patents issued during the month of February believed to be of interest or value to petroleum processing and handling operations

Catalytic Reactors

2,496,356 (Std. Oil Development Co.)—Fluid type conversion unit.
2,497,106 (Sinclair Refining Co.)—Apparatus for pyrolytic conversion of hydrocarbons.
2,498,832 (The Aerotec Corp.)—Apparatus for classifying and separating suspended particles from gases.
2,499,304-5 (Socony-Vacuum Oil Co., Inc.)—Apparatus for hydrocarbon conversion.

Processing, general

2,496,301 (Howard Iron Works, Inc.)—Tube bundle assembly for heat exchangers and the like.
2,497,136 (Std. Oil Development Co.)—Vapor-liquid contacting unit.
2,497,177 (Std. Oil Development Co.)—Differential gravity skimmer for waste separation.
2,497,359 (Richard H. Ahrens)—Cooling tower.
2,497,392 (Shell Development Co.)—Settler for separating immiscible liquids of different specific gravities.
2,498,145 (Ross Heater & Mfg. Co., Inc.)—Heat exchanger.
2,498,395 (Socony-Vacuum Oil Co., Inc.)—Agitator for apparatus used in determining liquid-vapor equilibria of organic liquids, such as crude oils, at high pressures and temperatures.



ANSWER:

"J. B. SPECIFIED ATLAS"

because of these advantages . . .

1 WIDE RANGE OF ACID AND ALKALI PROOF MATERIALS

2 COMPLETE TECHNICAL AND ENGINEERING SERVICE

3 LATEST MATERIALS THROUGH CONTINUOUS RESEARCH

4 LONG EXPERIENCE ASSURES CORRECT DESIGN

5 EXPERIENCED FIELD SUPERVISION AVAILABLE

HERE IS AN EXAMPLE OF AN ATLAS CORROSION-PROOF TRENCH

TYPICAL ACID PROOF TRENCH

Write us
10 Walnut Street, Mertztown, Penna.,
and get the facts.

THE ATLAS MINERAL PRODUCTS COMPANY

MERTZTOWN, PENNA. HOUSTON, TEXAS

Equipment Patent Review

2,498,717 (Foster Wheeler Corp.)—Heater for hydrocarbons.

Instruments

2,497,053 (Minneapolis-Honeywell Regulator Co.)—Measuring and controlling apparatus for catalyst regenerators.
2,497,255 (David P. Brown)—Differential pressure indicator.
2,497,919 (Interchemical Corp.)—Viscometer recorder.
2,498,506 (Atlantic Refining Co.)—Optical metering means for gas using a sliding tube.
2,498,941 (Swift & Co.)—Cloud point indicator.
2,499,076 (Republic Flow Meters Co.)—Apparatus for controlling fuel and air supply to boilers responsive to boiler demand.
2,499,105 (William M. Mercer)—Apparatus for determining initial boiling point of liquids.
2,499,322 (Socony-Vacuum Oil Co., Inc.)—Automatic aperture controlling device for infra-red spectrometer.

Pumps

2,496,586 (C. M. Kemp Mfg. Co.)—Rotary proportioning and mixing device for gas-fired burners.
2,496,676 (Rite-Way Products Co.)—Vacuum pump.
2,496,711 (Robert H. Goddard estate, assignor of one-half to The Daniel and Florence Guggenheim Foundation)—Pumping apparatus for very cold liquids such as hydrogen or oxygen.
2,497,300 (E. I. du Pont de Nemours & Co.)—Floating piston pump.
2,497,373 (Albert Z. Richards, Jr.)—Rotary fluid motor or pump.
2,497,616 (Worthington Pump & Machinery Corp.)—Oil pump drive for steam turbines.
2,497,704 (Crane Packing Co.)—Self-contained seal for pump shafts.
2,498,715 (Trondwell Engrg. Co.)—Sliding vane pump.

Tanks

2,496,626 (Pittsburgh-Des Moines Co.)—Spherical tank shell.
2,497,047 (Graver Tank & Mfg. Co., Inc.)—Center weighted floating roof.
2,497,645 (John H. Wiggins)—Floating tank roof drain.
2,497,850 (Chicago Bridge & Iron Co.)—Seal for floating roof tanks.
2,497,851 (Chicago Bridge & Iron Co.)—Lifter roof storage tank.
2,497,878 (Chicago Bridge & Iron Co.)—Sealing and leveling means for lifter roof tanks.

Tools

2,496,308 (Walter E. Pugh and Roy J. Champayne)—Lever actuated pivoted jaw wrench.
2,496,309 (Walter E. Pugh)—Lever actuated pivoted jaw wrench.
2,496,799 (Merle F. Lanckton estate)—Pipe wrench.
2,497,214 (William F. Dreyer)—Stud extractor tool.
2,497,500 (Corrie Hightower and Herold Springett)—Pipe bender and straightener.
2,497,622 (Tal's Prestal Bender, Inc.)—Pipe bending apparatus with pivoted side shapers.
2,499,327 (Charles H. Ortman)—Pivoted outer jaw wrench.

Valves and Fittings

2,496,451-2 (McEvoy Co.)—Refinery valves.
2,496,503 (Edgar Earle Littlefield)—Valve mechanism.
2,496,638 (General Controls Co.)—Fluid control valve.
2,496,740 (Economy Pumps, Inc.)—Hydraulic valve operating mechanism.
2,496,858 (Ludlow Valve Mfg. Co., Inc.)—Check valve.
2,497,086 (Dorothy S. Kiene)—Check valve for internal combustion engines.
2,497,780 (Phillips Petroleum Co.)—Reducing thermal shock high-temperature valve.
2,497,860 (Chicago Bridge & Iron Co.)—Pressure relief valve for storage tanks.
2,497,986-7 (Joseph H. Goode)—Adjustable pipe connection.

How to Obtain Patents

Readers may obtain copies of U. S. patents from the Patent Office at 25c each. Order by patent number direct from the Commissioner of Patents, Washington 25, D. C.

BIG business

Making an item like this is a job for a big plant—one with a set-up and experience in building important units. It's big business any way you look at it, and Sun Ship, with its vast facilities, experience and know-how, is the outfit able to handle it . . .

The 11′ x 139′ Deisobutanizer Column pictured above is a sample of the Sun-built refinery and chemical plant equipment that has made the name Sun Ship as famous on land as the Sun-built tankers and cargo ships that ply the seven seas.

Sun

SHIPBUILDING & DRY DOCK COMPANY

SINCE 1916

ON THE DELAWARE • CHESTER, PA.

25 BROADWAY • NEW YORK CITY

[To obtain more data on advertised products see page 424]

Patent Trends in Petroleum Refining

By Peter J. Gaylor, Editor "The Technical Survey"

Fluidized Solids Technique Adopted for Adsorption

AN interesting method for separating normally liquid components from gas or vapor streams is disclosed in U. S. Patent 2,493,911 issued to Pan American Refining Corporation. In this case, fluidized adsorbent, such as finely divided silica gel of .001-.01 inch particle size is employed as the sorption medium.

As can be seen from the schematic diagram presented in Fig. 1, the "wet" gas is charged into adsorber tower 10 through line 20, countercurrent to the flow of finely powdered adsorbent in tower 10 which is cooled by water jacket 51. Lean gas, from which the normally liquid products have been removed by the adsorbent, is withdrawn from the top of tower 10 through line 24, while the adsorbent saturated with normally liquid components passes through heated section 22 (heated by jacket 26) and into the bottom section of standpipe 32 which is heated by heater 31 to desorption temperature. The remaining portion of standpipe 32 is likewise heated by jacket 36, so that the desorbed gas leaving the adsorbent acts as a gas lift to propel the powdered adsorbent upwardly into separator section 12, from which the desorbed, normally liquid product is withdrawn through line 40, while the adsorbent is cooled in section 13 and returned to adsorber tower 10 for recycling.

Aeration gas is fed in at various points through lines 18, 25, 28 and 29 to keep the finely dispersed adsorbent in a "fluid" state. After passing through condenser 41, the liquefied desorbed product is collected in receiver 42, and since some finely divided adsorbent is brought along with the liquid product, it is returned to separator section 12 in the form of a slurry by pump 48, while the clear liquid product is drawn off through line 44. Aeration gas is forced into line 46 by compressor 45.

Simplified Moving Bed Catalytic Cracking

BY employing a combustible support for its cracking catalyst, Phillips Petroleum Company, in its U. S. Patent 2,490,975, indicates a method whereby regeneration of the catalyst may be avoided or simplified to enable catalytic cracking in a unit of practically skeletal design.

In this system, which is depicted by a flow sheet shown in Fig. 2, the carrier or combustible support, which may be charcoal, coke, sawdust, etc. of 8-14 mesh is withdrawn from hopper 1 and led into tumbling drum 2 rotating at about 30 rpm and in which an aqueous suspension of alumina containing dissolved promoters is sprayed onto the carrier in the form of a 10% slurry. The carrier plus adsorbed catalyst then flow into dehydrator 3 countercurrent to a stream of preheated steam and air at 900-1400° F., heat being supplied by partial combustion of the combustible carrier. The slurry is thus dehydrated on the support and the activated catalyst is run into reactor 4 where it concurrently contacts the

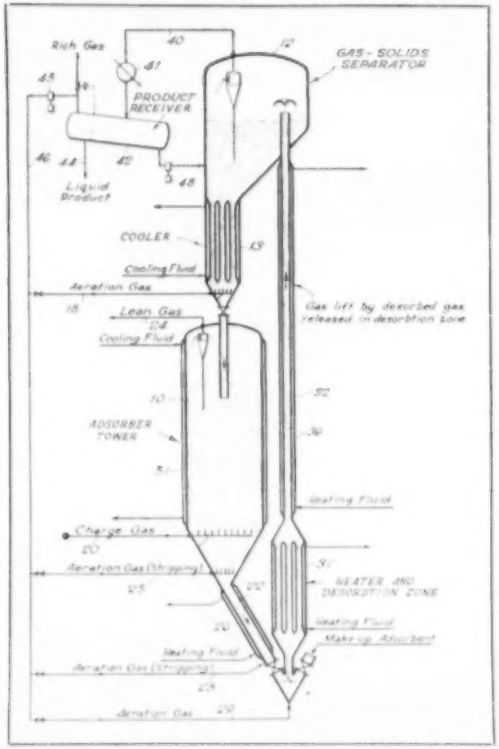
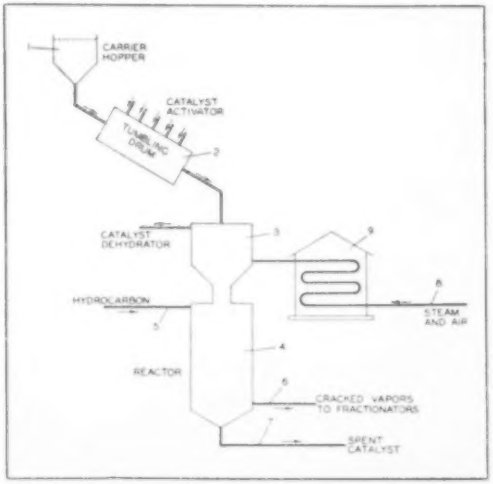


Fig. 1—Left; adsorption using a fluidized solids technique employs finely divided silica gel as the sorption medium (U. S. 2,493,911)

Fig. 2—Below: catalyst regeneration is greatly simplified in a cracking process which utilizes a combustible catalyst support (U. S. 2,490,975)



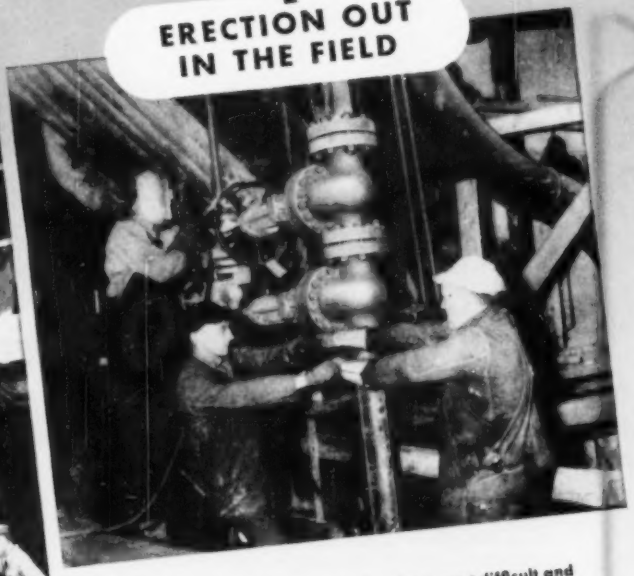
YOU GET BETTER PIPING

because MIDWEST knows piping problems

INSIDE and OUT

PREFABRICATION IN THE SHOP

ERECTION OUT IN THE FIELD



Because Midwest has erected some of the most difficult and exacting piping jobs out in the field, in addition to having prefabricated them in the shops, we have a clear, competent view of piping problems from every angle.

Our Fabricating Department works closely with the Contracting Department . . . continually seeking ways of making their job easier, less costly, and higher in quality. The Contracting Department is always ready to make practical suggestions for improving prefabricated piping subassemblies. It is in constant and intimate touch with piping users in all types of industry. Changes in needs—changes in thinking are quickly relayed to the whole Midwest organization.

The net result to you is better piping whether you want a simple pipe bend . . . a series of complex prefabricated subassemblies . . . or a difficult piping job completely erected.

MIDWEST PIPING SERVICE IS NATION-WIDE

4 PLANTS ARE BETTER THAN 1

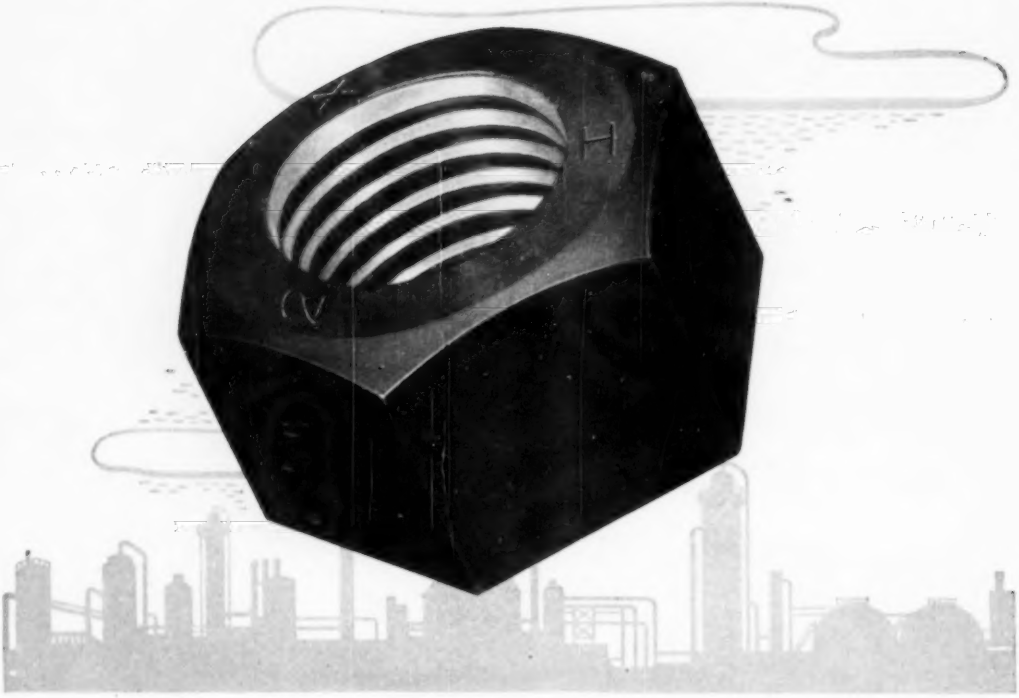
PIPING FABRICATORS AND CONTRACTORS

MIDWEST PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and South Boston

Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg.
Tulsa 3—533 Mayo Bldg. • South Boston 27—426 First St.



GIVES A GOOD ACCOUNT OF ITSELF AT ELEVATED TEMPERATURES

In the high temperature bolting jobs encountered in refineries, you can always count on faithful service from the Bethlehem Quenched Nut.

The Bethlehem Quenched Nut gives a good account of itself in high-temperature, high-pressure applications because of its built-in strength. This is the result of *hot forging*. The nut is not merely punched from a hot bar, but is actually formed by forging and extruding hot metal into a forming die. This method of manufacture, plus liquid quenching and tempering heat treatment, produces a nut strong enough to break any stud or bolt on which it is used.

The Quenched Nut has a highly refined, tough grain structure, and oxidized sides which are resistant to corrosion. Its ground bearing surface is definitely superior to common, machined surfaces.

The Quenched Nut is produced at Bethlehem's Lebanon, Pa., plant, and is carried in stock in bolt sizes from 3/8 in. to 3 1/2 in. It conforms in every respect to Grade 2H of ASTM Specification A194. Lebanon Plant also stocks nuts in Grades 0, 1, 2 and 4. For complete details about nuts for high-temperature bolting, contact the nearest Bethlehem sales office, or write to us at Bethlehem, Pa.

BETHLEHEM QUENCHED NUT

Grade 2H

Chemical Composition

Carbon	0.40 min
Phosphorus	0.05
Sulphur	0.05

Hardness Requirements

Brinell	248 to 352
Rockwell C	24 to 37

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Bethlehem supplies every type of Fastening

gas oil entering through line 5. Cracked vapors are withdrawn through pipe 6, while spent catalyst is removed from the bottom of the reactor through line 7. A 45% yield of 78 octane gasoline is claimed to be obtained in this manner.

Steam and air used in the dehydration may be preheated in furnace 9.

Isomerization

THE use of a molten catalyst in the isomerization of saturated hydrocarbons is a desirable feature from the point of view of catalyst efficiency and conversion. However, most catalysts have rather high melting points which preclude their use for this purpose due to excessive cracking at such temperatures.

One patent recently issued to Universal Oil Products Co. (U. S. 2,490,853) features a eutectic mixture of zinc chloride and aluminum chloride. Aluminum chloride solidifies at about 190° C. while zinc chloride solidifies at about 263° C. Yet a mixture of 38% zinc chloride and 62% aluminum chloride solidifies at the low temperature of about 95° C.

Deodorizing Waxes and Oils

SOCONY-VACUUM Oil Co. discloses a process for producing moisture-free, odorless refined oils and waxes by first blowing with air at 170-190° F. to remove moisture, and then introducing a small amount of gaseous sulfur dioxide sufficient to remove the rancid odor developed from the air blowing operation (U. S. 2,498,201).

Patents Issued in February

The following classification listing gives the patent number, patentee or assignee, and a brief description of all patents believed to be of direct interest to the petroleum processing industries, as contained in the Official Gazettes of the U.S. Patent Office for February 7, 14, 21, and 28, Vol. 631, Nos. 1-4.

Fuels

2,496,983 (Ethyl Corp.)—Antiknock mixture containing halogenated ether scavenger.
2,498,630 (Universal Oil Products Co.)—Gasoline inhibited with alkylated p-phenylene diamine.

Conversions

2,496,356 (Standard Oil Development Co.)—Catalytic reactor.
2,497,106 (Sinclair Refining Co.)—Pyrolytic conversion of hydrocarbons.
2,497,940 (Standard Oil Development Co.)—Finely divided catalyst conversion.
2,498,068 (Standard Oil Development Co.)—Conversion of hydrocarbons with suspended catalyst.
2,498,700 (Shell Development Co.)—Zn-Cr activated alumina aromatizing catalyst.
2,498,789 (Phillips Petroleum Co.)—Recovery of HF in alkylation.
2,498,840 (Standard Oil Development Co.)—Catalytic cracking of diisobutylene.
2,498,853 (The Pure Oil Co.)—Cracking in presence of bromocyclohexane.
2,499,204 (Socony-Vacuum Oil Co.)—Catalytic cracking.
2,499,305 (Socony-Vacuum Oil Co.)—Gaseous conversions in presence of moving contact material.

Refining

2,496,536 (Air Reduction Co.)—Desulfurizing distillates with copper soaps.
2,497,095 (Mathieson Chemical Co.)—Recovery of elemental sulfur from acidic gases.
2,497,136 (Standard Oil Development Co.)—Vapor-liquid contacting unit.
2,497,159 (Standard Oil Development Co.)—Separating pentenes with cuprous salt in nitrogen base.
2,497,176 (Standard Oil Development Co.)—Hydrogenation catalyst.
2,497,177 (Standard Oil Development Co.)—Differential gravity skimmer.
2,497,421 (Shell Development Co.)—Absorption process.
2,497,588 (The Texas Co.)—Refining oil with a selective solvent.
2,497,967 (Standard Oil Development Co.)—Removal of oxygenated compounds from synthetic naphthas.
2,498,177 (Refinery Maintenance Corp.)—Dethanizing rich oil.
2,498,204 (Socony-Vacuum Oil Co.)—Purifying lower olefins.
2,498,559 (M. W. Kellogg Co.)—Desulfurizing naphtha with molybdenum oxide and hydrogen.
2,498,629 (Standard Oil Development Co.)—Treating oils with 98% sulfuric acid containing 1-2% HF.
2,498,656-8 (Petrolite Corp.)—Breaking petroleum emulsions.
2,498,794 (Phillips Petroleum Co.)—Removal of magnetic material from furfural.

Power-laden Btu's are odds-on-favorites to escape whenever inadequate or no insulation affords the opportunity.

Keep Btu's on the job with efficient, fuel-saving CAREY Industrial Insulation. Cut production costs—raise efficiency—improve employee morale, save fuel!

And now—a new improved insulation...

CAREY TEMPCHEK

a specialized product with a wide temperature range up to 1500°F, low K factor, rugged strength, excellent "Handleability"—

a combination of outstanding qualities . . .

Ask about it!

Don't let Btu's get the jump on you! Call in your CAREY representative today—he's a trained expert, eager to serve you.

CAREY Makes the Complete Line!

85% Magnesia—Industrial Rock Wool—Asbestos—Pipe Coverings—Sheets—Blocks—Batts—Papers—Air-Cell.

Write for your **free** copy of "Heat Insulation For Industry." Address your request to Dept. PP-5, The Philip Carey Manufacturing Company, Cincinnati 15, Ohio. In Canada: The Philip Carey Company, Ltd., 1557 MacKay Street, Montreal 25, P. Q.

A PRODUCT OF THE HOUSE OF Carey

[*To obtain more data on advertised products see page* 424]

2,498,928 (Phillips Petroleum Co.)—Separation of cyclopentane-neohexane by azeotropic distillation.

Chemicals

2,496,384 (Shell Development Co.)—Emulsion polymerization of copolymers.
2,496,621 (Union Oil Co. of California)—Catalytic hydration of olefins.
2,496,660-1 (Socony-Vacuum Oil Co.)—Aromatic nitriles.
2,496,669 (Socony-Vacuum Oil Co.)—Copolymerization of thiophene with styrene.
2,497,100 (Phillips Petroleum Co.)—Mercaptoalkoxy-thio ethers.
2,497,138 (Standard Oil Development Co.)—Dechlorinating sulfurized diisobutylene reacted with SCl_2.
2,497,152 (Standard Oil Development Co.)—Purifying petroleum mahogany sulfonates.
2,497,191 (Standard Oil Development Co.)—Pure isobutylene.
2,497,296 (DuPont)—Purifying ethylene containing acetylene.
2,497,303-4 (DuPont)—Reaction between olefinic compounds, carbon monoxide and hydrogen.
2,497,349 (Union Oil Co. of Calif.)—Alicyclic alcohols.
2,496,422 (Phillips Petroleum Co.) — Alkoxy thiols.
2,496,548 (Shell Development Co.)—Amino alcohols.
2,497,959 (Standard Oil Development Co.)—Alcohol process.
2,497,968 (Standard Oil Development Co.)—Polyester.
2,497,973 (Celanese Corp. of America)—Cooling oxidation reaction gases.
2,497,997 (Union Oil Co. of Calif.)—Purifying alcohols.
2,498,195 (Shell Development Co.)—Amino alkylene-oxide polymerization product.
2,498,286 (Cities Service Oil Co.)—Paraformaldehyde.
2,498,412 (Shell Development Co.)—Unsaturated imines.
2,498,444 (Orr)—Acetylene by endothermic reaction of hydrocarbons.
2,498,453 (Shell Development Co.)—Polyvinyl chloride compositions containing sulfuric acid treated high boiling petroleum extract.
2,498,546 & 52 (Socony-Vacuum Oil Co.)—Halogenated hydrocarbons using fluidized solids.
2,498,567 (Monsanto Chemical Co.) — Ethyl benzene.
2,498,607 (Polymerization Process Corp.)—Activating olefins in condensation reactions.
2,498,710 (Standard Oil Development Co.)—Burning lime using fluidized solids technique.
2,498,808 (Phillips Petroleum Co.)—Ethylene.
2,498,872 (The Pure Oil Co.)—Mercaptan synthesis.
2,498,936 (Socony-Vacuum Oil Co.)—Aliphatic trithiocarbonates.
2,498,996 (Gulf Research & Development Co.)—Isobutylene by depolymerizing polymers.
2,499,236 (Standard Oil Development Co.)—Purifying mixed alkyl phenols.

Lubricants

2,496,508 (Standard Oil Co. Ind.)—Epoxide-stabilized sulfurized oil which normally evolves H_2S.
2,496,798 (The Texas Co.)—Rust inhibiting lubricating composition containing n-dodecyl thiosuccinate.
2,497,067 (Standard Oil Co. Ind.)—Stabilizing with quinone, substances tending to give off H_2S.
2,497,059 (Gulf Oil Corp.)—Polyvalent metal salt compound as lube additive.
2,497,132 (Standard Oil Development Co.)—Organic metal compound as lube additive.
2,497,133 (Standard Oil Development Co.)—Lithium grease containing zinc naphthenate.
2,497,321 (Gulf Research & Development Co.)—Oil compositions containing amine salts of boro-diol complexes.
2,498,863 (Socony-Vacuum Oil Co.)—Thiocarbonate in lubricating oil.
2,498,961 (Socony-Vacuum Oil Co.)—Mineral oil containing morpholine condensation product.

Hydrocarbon Synthesis

2,496,265 (Standard Oil Development Co.)—Hydrocarbon synthesis with fluidized catalyst.
2,496,342 (Standard Oil Development Co.)—Reforming methane to synthesis gas.
2,496,343 (Standard Oil Development Co.)—Red-iron oxide fluid catalyst for hydrocarbon synthesis.
2,497,761 (Phillips Petroleum Co.)—Hydrocarbon synthesis.
2,497,932 (Standard Oil Development Co.)—Hydrocarbon synthesis.
2,497,964 (Standard Oil Development Co.)—Hydrocarbon synthesis.
2,498,838 & 45 (Standard Oil Development Co.)—Hydrocarbon synthesis.

Specialties

2,497,432-3 (Monsanto Chemical Co.)—Anti-rusting composition.

Catalysts

2,496,396 (Universal Oil Products Co.)—Inorganic oxide spherical particles.
2,498,353 (Bierce) — Activated magnesium silicates.
2,499,255 (Union Oil Co. of California)—Molybdenum oxide conversion catalyst.

Miscellaneous

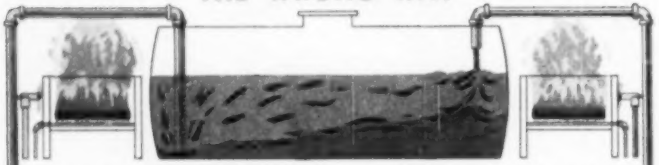
2,496,354 (Cities Service Oil Co.)—Preventing corrosion of metals exposed to brines and hydrogen sulfide by adding melamine.
2,496,595-6 (Cities Service Oil Co.)—Formaldehyde corrosion inhibitor compositions.
2,497,150 (Standard Oil Development Co.)—Controlling foaming in alkyl chloride process with lauryl sulfate.
2,497,939 (Standard Oil Development Co.)—Oil projecting device.
2,497,946 (Dravo Corp.)—Purging hydrocarbon-containing chambers.
2,499,020 (Standind Oil & Gas Co.)—Gas analysis.
2,499,043 (Standard Oil Co. Ind.)—Refriger-

How to Obtain Patents

Readers may obtain copies of any U. S. patent from the Patent Office at 25 cents each. Order by patent number direct from the Commissioner of Patents, Washington 25, D. C.

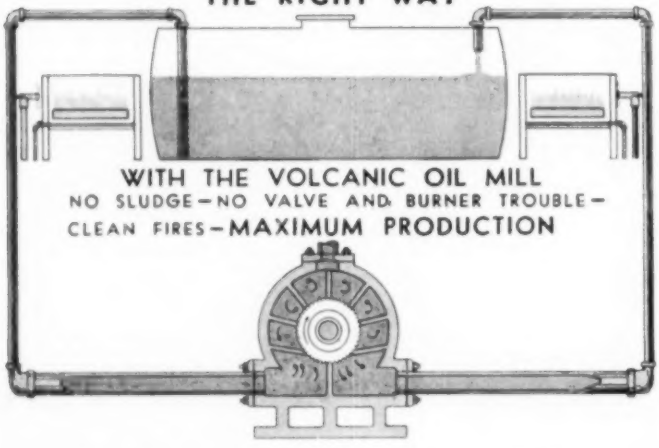
TWO WAYS OF BURNING OIL

THE WRONG WAY



SLUDGE IN STORAGE—VALVE AND BURNER TROUBLES—
UNBURNED OIL—LOST PRODUCTION

THE RIGHT WAY



WITH THE VOLCANIC OIL MILL
NO SLUDGE—NO VALVE AND BURNER TROUBLE—
CLEAN FIRES—MAXIMUM PRODUCTION

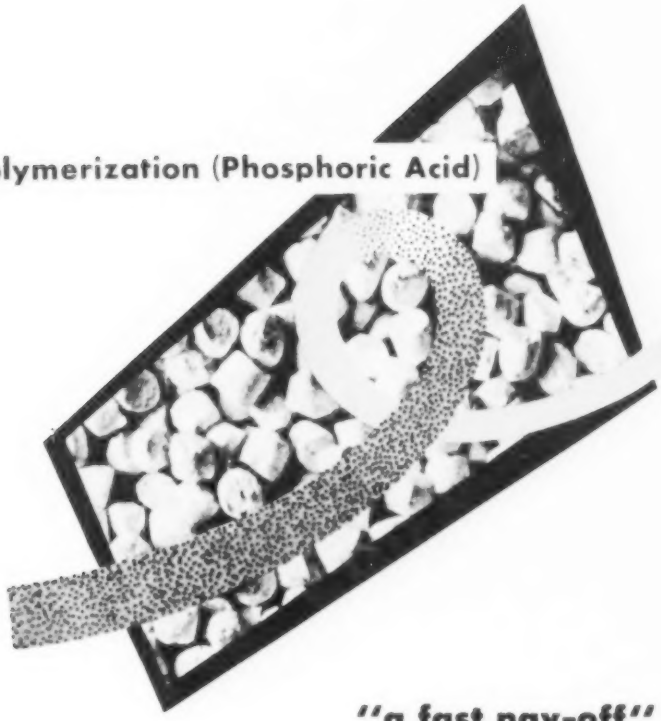
You can get complete details for a 3c stamp—try it!

HOPKINS' VOLCANIC SPECIALTIES

ALLIANCE, OHIO

[To obtain more data on advertised products see page 424]

Polymerization (Phosphoric Acid)



"a fast pay-off"

Catalytic Polymerization (Phosphoric Acid) is probably the most economically attractive process in Petroleum Refining. It is a simple low-cost operation, and if properly designed, will remain on stream for extended periods. A Foster Wheeler designed polymerization unit recently completed 3 years of continuous operation before it was shut down for general inspection.

Foster Wheeler will build within the next year 3 large polymerization units and the design and construction experience gained from these projects is available to other refiners,—anywhere in the world.

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

"Out of the sands of Iran"

. . . rises one of the world's largest Fluid Catalytic Cracking Units, designed and constructed by Foster Wheeler.

Four other "Fluid" units (one larger than the Abadan unit in the above illustration) are in various stages of Foster Wheeler design and construction.

design

engineering

fabrication

construction

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

The Complete Engineering and Construction Service
Anywhere in the World

Book Reviews

Esso's Data on Hydrocarbons Made Available in New Book

Data Book on Hydrocarbons, by J. B. Maxwell; 7 x 10 in.; viii + 259 pages, indexed, illustrated, stiff cloth binding, $5.00. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y.

Earlier editions of the *Data Book on Hydrocarbons* were used by the Standard Oil Development Co. and its affiliates. Because it proved to be of high value to technical personnel, Standard Oil Development decided to make it available to practising engineers and students of petroleum technology.

Its primary purpose is to provide basic data on hydrocarbons and petroleum fractions, to provide methods of applying these data to process engineering, including illustrative examples and some fundamental theory, and to provide applications of a few of the unit operations of chemical engineering used extensively in the petroleum industry.

As might be expected, the major portion of the book is devoted to well-done charts, alignment charts, etc., covering such information as vapor pressure, fugacities, critical temperatures and pressures, various thermal properties, enthalpies, density, viscosity, heats of combustion, etc.

A considerable amount of invaluable data has been compiled here in a workmanlike manner. The choice of blue ink is unfortunate, at least insofar as reproduction of some of the charts is concerned. As a result of printing in blue, some of the essential information on several curves has been all but lost. It is virtually impossible to distinguish, for example, between the subscripts 6 and 8.

The book, however, is a volume which should be of great help to all engineers concerned with the design, and operation of petroleum processing equipment.

Insurance Company Publishes Comprehensive Safety Manual

Safety in Petroleum Refining and Related Industries, 1st Edition, compiled by George Armistead, Jr.; 7⅝ x 10⅝ in., 416 pages, indexed, illustrated, stiff cloth binding, $10.00. John G. Simmonds & Co., Inc., 111 John St., New York 7, N. Y.

Safety in Petroleum Refining and Related Industries concerns itself chiefly with the engineering phase of accident prevention—proper equipment, correct design, and safe operation and layout, inspection and maintenance, etc. After introductory chapters on principles and fundamentals, the editor presents chapters on specific aspects; for example, plant layout, fire protection of structures, mechanical standards, operating, inspection, and maintenance practices, relief and blowdown systems, storage tanks, electricity, and fire control and extinguishment.

A useful appendix includes properties of flammable materials, table of common hazardous chemicals, specifications for reinforced concrete fire protection insulation, inspection tools and equipment, retiring thicknesses for heater tubes and other types of piping.

The book undertakes to gather in one volume much information which of course, has been published previously in greater detail but in many different sources. It succeeds admirably. It is the work of Mr. Armistead and his associates, Washington consulting chemical engineers, and was prepared as a service to the petroleum industry by the Simmonds firm, who are oil insurance underwriters. Mr. Fred O. Clark, president of Simmonds, explains in a foreword that his organization concurs generally in the recommendations made in the book, but that such recommendations do not have direct connection with or form the basis of any insurance rating schedules prevailing in the industry.

ASTM Issues Latest Edition Of Petroleum Standards

A.S.T.M. Standards on Petroleum Products and Lubricants (With Related Information), 1949 Edition, American Society for Testing Materials, Committee D-2; 6 x 9 in., 750 pages, in heavy paper cover, $5.50; in cloth cover, $6.15. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna.

This latest (November 1949) compilation of *ASTM Standards on Petroleum Products and Lubricants* brings together most of the standards, test methods, and specifications widely used in the field. The methods of test for knock rating of engine fuels are issued in a special manual and not included in this book.

This edition gives, in their latest form, 120 standards, including 102 test methods, 12 specifications, 2 lists of definitions relating to petroleum and rheological properties of matter, 2 tentative recommended practices, and other material. New material includes tentative test methods for: aniline point and mixed aniline point of hydrocarbon solvents; benzene and toluene by ultraviolet spectrophotometry; hydrogen in petroleum fractions by the lamp method; olefinic plus aromatic hydrocarbons in petroleum distillates; acetylene in polymerization grade butadiene by silver nitrate method; oxygen in butadiene vapors by manganous hydroxide method; peroxides in butadiene by ferrous-titanous method.

Separation of residue from butadiene; butadiene dimer in polymerization grade butadiene non-volatile residue of polymerization grade butadiene; sodium in lubricating oils and lubricating oil additives; distillation range of lacquer solvents and diluents; and tentative methods of testing and standardization of etched-stem liquid-in-glass thermometers.

Appendices include, in addition to the report of Committee D-2, proposed methods of test for: determination of micro cone penetration of lubricating grease; apparent viscosity of lubricating greases; sulfur in petroleum products by the CO_2—O_2 method; boiling point range of polymerization grade butadiene; phosphorus in lubricating oils, lubricating oil additives, and their concentrates; bromine number of petroleum distillates (color indicator method and electrometric method).

Association Publications

Method and Procedure for the Determination of Dissolved Oxygen, 1st Edition, Standards of the Heat Exchange Institute: 8½ x 11 in., 32 pages, stiff paper binding, $2.00. (1949) Order direct from Heat Exchange Institute, 90 West Street, New York 6, N. Y., attn. C. C. Rohrbach, secretary.

Symposium on Insulating Oil, presented at meetings of ASTM Committee D-9 on Electrical Insulating Materials: First Series—Oct. 16, 1946. Second Series—June 17, 1947; Third Series—March 23, 1949. *First and Second Series combined*, 48 pages, 8¼ x 11¼ in., 75c; 1949 *Third Series*, 56 pages, 6 x 9 in., $100; all three Symposiums, $1.35. Order direct from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna.

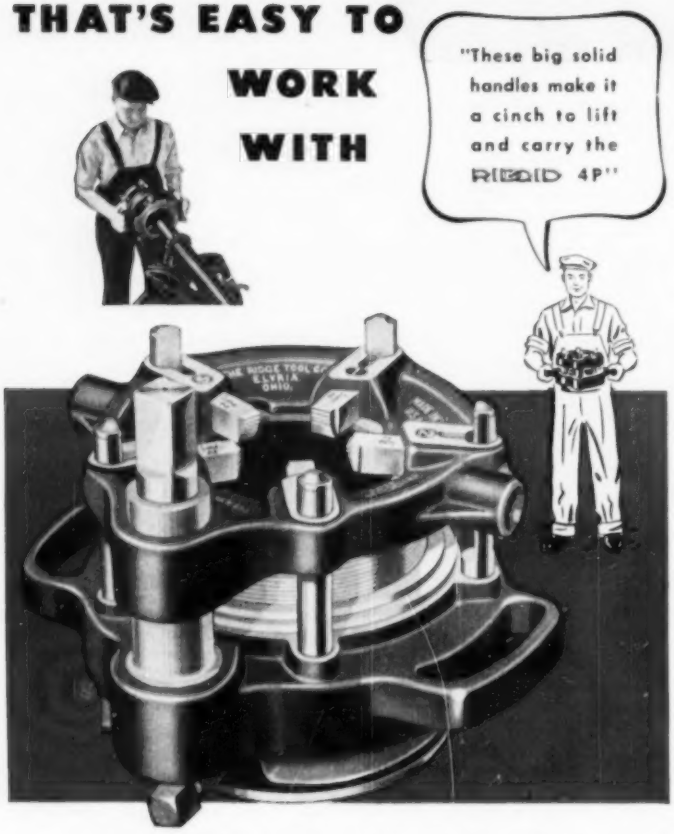
A.S.T.M. Standards on Benzene, Toluene, Xylene, Solvent Naphtha, December, 1949; Committee D-16 on Industrial Aromatic Hydrocarbons: 6 x 9 in., 44 pages, paper cover, $1.00. Order direct from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna.

A.S.T.M. Standards on Gaseous Fuels, December, 1949; Committee D-3 on Gaseous Fuels: 6 x 9 in., 100 pages, paper cover, $1.15. Pamphlet includes methods of test for liquefied petroleum gases. Order direct from the ASTM, 1916 Race St., Philadelphia 3, Penna.

Residual Stresses in Metals, by William Marsh Baldwin, Jr., the

A Geared Pipe Threader

THAT'S EASY TO WORK WITH



RIDGID No. 4P cuts perfect threads on 2½" to 4" pipe

● No matter how good a threader is, it's a lot better if it's easy to handle. RIDGID 4P has balanced loop handles so you can easily pick it up and put it on pipe—even when it's greasy and you're tired. Mistake proof workholder sets to size *before* you put it on pipe, one screw to tighten, no bushings. 4 sets of 5 high-speed steel chaser dies give clean accurate threads on 2½," 3," 3½" and 4" pipe. Ratchet handle furnished—RIDGID Universal Drive Shaft and Power Drive available for power-threading. For perfect threads, easily, order the RIDGID 4P from your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

Book Reviews

A.S.T.M. Edgar Marburg Lecture for 1949; 6 x 9¼ in., 48 pages, paper cover, $1.00. Order direct from the ASTM, 1916 Race St., Philadelphia 3, Penna.

Government Publications

Sulfur in Petroleum, III. Selected Physical Properties of Some Sulfur Compounds: Report of Investigations 4566, November, 1949; by R. Vernon Helm, William E. Haines, and John S. Ball, Dept. of Interior, Bureau of Mines; 8 x 10½ in., 44 pages, heavy paper binding.

Guide for Making Cost Estimates for Chemical-type Operations: Report of Investigations 4534, November, 1949; by C. W. Van Noy, T. C. Dunville, R. G. Dressler, and C. C. Chaffee, Dept. of Interior, Bureau of Mines; 8 x 10½ in., 64 pages, heavy paper binding.

Report of Petroleum and Natural Gas Branch, Fiscal Year 1948: Information Circular 7532, December, 1949; by R. A. Cattell and Others, Dept. of Interior, Bureau of Mines; 8 x 10½ in., 64 pages, heavy paper binding.

National Motor-Gasoline Survey, Summer 1949: Report of Investigations 4644, December, 1949; by O. C. Blade, Dept. of Interior, Bureau of Mines; 8 x 10½ in., 32 pages, heavy paper binding.

A Method of Test for SO_2 and SO_3 in Flue Gases: Report of Investigations 4618, January, 1950; by A. A. Berk and L. R. Burdick, Dept. of Interior, Bureau of Mines; 8 x 10½ in., 10 pages, heavy paper binding.

Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants, Information Circular 7516, compiled by W. I. Barnet, U. S. Bureau of Mines; 8 x 10½ in., 53 pages, heavy paper binding.

Petroleum Refineries, Including Cracking Plants, in the United States, January 1, 1949, Information Circular 7537, by F. S. Lott and I. S. Culver, U. S. Bureau of Mines; 8 x 10½ in., 21 pages, heavy paper binding.

Studies of the Kinetics of Coal Hydrogenation, Report of Investigations 4546, by M. G. Pelipetz, E. M. Kuhn, S. Friedman, and H. H. Storch; 8 x 10½ in., 9 pages, heavy paper binding.

The Determination of Low Concentrations of Hydrogen Sulfide in Gas by the Methylene Blue Method, Report of Investigations 4547, by A. E. Sands, M. A. Grafius, H. W. Wainwright, and M. W. Wilson; 8 x 10½ in., 19 pages, heavy paper binding.

Order copies of the above booklets from the Bureau of Mines, Publication Office, 4800 Forbes St., Pittsburgh 13, Penna.

How much should a valve cost?

Only as much as is necessary for it to meet all the conditions under which it must operate.

When the service in which a valve is to be used requires special design and materials, it is poor economy to try to make an inexpensive valve do the job. "Down time", maintenance costs, if not actual valve failure, will far more than offset any initial saving.

On the other hand, in a majority of services, standard Powell Valves satisfy all requirements for long, trouble-free performance.

And, because Powell makes all kinds*, it is the soundest economy to standardize on Powell Valves for all your flow control requirements.

Fig. 1561—Class 150-pound Cast Steel Swing Check Valve with flanged ends and bolted cap.

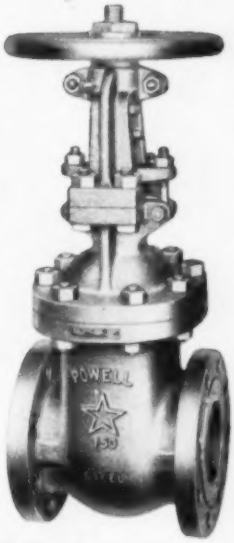


Fig. 1503—Class 150-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 375—200-pound Bronze Gate Valve. Screwed ends, inside screw rising stem, union bonnet, renewable wear resisting "Powellium" nickel-bronze disc.

Fig. 1460—Iron Body Bronze Mounted "Master Pilot" Gate Valve with screwed ends, rising stem, bolted flanged bonnet and tapered solid wedge.

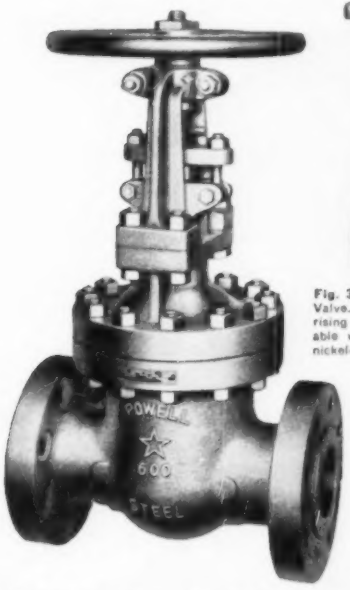


Fig. 6003—Class 600-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

***The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief, and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant Metals and alloys.**

Ask your nearest Distributor—or write direct

The Wm. Powell Company, Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL VALVES

[*To obtain more data on advertised products see page* 424]

OLD DUTCH REPORTS

"Platformed gasoline has truly proved a boon to our sales department." That's the report from Old Dutch Refining Company, Muskegon, Michigan, where the first of the Platforming units has already proved its importance sales-wise.

"Where over-all gasoline inventories in this country are approaching an all time high, Old Dutch Refining Company has had no problem in this respect;

where

PLATFORMATE

pays off!

Blend *your* gasoline with Platformate, the product of the UOP Platforming process, and watch it pay off . . . in terms of increased gallonage.

Platformate is a blending component that boosts product quality even when your gasoline is made from the poorest stocks. Road octane of Platformate itself, when produced from the lowest octane naphthas (with 3 cc of lead) is rated nearly 100.

Platformate is inherently stable and negligible in sulfur content. There is more energy per gallon. The odor is pleasant. Production is economical.

Where increased gallonage depends on improved quality, depend on Platformate.

UNIVERSAL OIL PRODUCTS COMPANY

UOP General Offices: 310 S. MICHIGAN AVENUE, CHICAGO 4, ILL., U.S.A.
LABORATORIES: RIVERSIDE, ILLINOIS

Universal Service Protects Your Refinery

thanks to Platformed gasoline and the superior performance and quality it offers.

"Checking the sales figures of our branded outlets for a thirty-five day period this year against the same period in 1949, indicates a substantial increase in gallonage. New markets have been opened for a gasoline superior in anti-knock quality to the ordinarily accepted premium grade. New customers have been converted to regular customers . . . particularly the owners of new cars."

for users of Caustic Soda

• This completely new 48-page book entitled "Mathieson Caustic Soda" is now available to users throughout industry. Fully illustrated, it covers in detail the manufacture, economics, properties, handling and sampling of this product.

In 1923, Mathieson was the first to make regular shipments of caustic soda in liquid form. Today, because of the expanded productive capacities of its three large plants at Saltville, Va., Lake Charles, La., and Niagara Falls, N. Y., Mathieson is recognized as one of the leading suppliers of liquid caustic soda.

Users will find this new detailed book helpful in connection with the handling and application of caustic soda. Write for your copy today. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

Mathieson
CHEMICALS

8127

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

REFINING TRENDS

March Cold Brings Peak Heating Oil Demand at Refineries

DISTILLATE fuels in March caught the impact of the late winter cold weather and the prolonging of the coal strike, just as residual fuels felt their effect in February. The normal seasonal trend in demand was entirely reversed and March demand reached the peak of the season, it is indicated. See Fig. 4.

Production of kerosine and distillates in March followed the normal seasonal trend to ease off, and the brunt of the increase in demand fell on refiners' inventories. Heating oil stocks (kerosine and distillates) were reduced around 16,500,000 bbls. See Fig. 5. By comparison, the reduction in these stocks in March, 1949, was around 6,000,000 bbls., and in March, 1948, only about 2,200,000 bbls.

Heating oil stocks at the end of March were about in the same relationship to gasoline stocks as for recent years except for 1949. Their volume was roughly one third of gasoline stocks at the date when heating oil stocks normally start to build up and gasoline stocks to decline. See Table 1. However, in view of the larger proportionate increase in demand for heating oils as compared with demand for motor fuel, as shown in Table 2, this approximate 1:3 relationship may not be normal at present. Heating oil demand has increased about 30% in the past 5 years, and motor fuel demand 21 to 22%.

Since gasoline stocks are considered relatively high at their level at the end of March of around 135,500,000 bbls., the general trend in overall refinery operations in coming months might be to put the emphasis on high yields of distillate fuels to build up these inventories and to hold gasoline yields at a point that would liquidate gasoline stocks at more than the normal seasonal rate.

Residual Fuels — This product resumed a normal seasonal trend in March after taking in February the impact of the cold and the coal strike. While indicated refinery output was 8% less than in March, 1949, much heavier imports brought the indicated total rate of supply to about 2% above March 1949. Indicated demand at refineries in March was 12% higher than the year before. Total U. S. stocks were drawn on by around 5,300,000 bbls. Indicated stocks east of California are under 20,000,000 bbls. for the first time in two years.

The indicated rate of supply of residual fuels for the first quarter of 1950, 1,482,000 b/d avg., is around 2% higher than actual supply for the first quarter of 1949. Indicated rate of demand for the first quarter, 1,700,000 b/d avg., is 10% larger than for 1949.

Crude Runs—Trend in March was close to the rate for March '49. Runs of domestic crude were 1% under March '49. Indicated total runs to stills for the first quarter of 1950 is 5,395,000 b/d avg., which is about 2% under actual runs for the first quarter of 1949. Indicated runs for the first quarter are slightly under the Bureau of Mines forecast figure of 5,450,000 b/d avg. Bureau of Mines forecast of crude runs for April, 5,330,000 b/d avg.

Motor Fuels—Indicated March rate of production was about 2% higher than in March, 1949, and this is about the average trend for the first quarter. Rate of motor fuel output for the quarter, 2,612,000 b/d avg., compares with 2,567,000 b/d avg. actual for the first quarter of 1949. Indicated demand for the first quarter is relatively a little stronger, 2,344,000 b/d avg., compared with 2,288,000 b/d avg. actual for the preceding first quarter, a gain of around 2.5%.

The indicated peak for gasoline stocks for the current season of building up storage is around 135,500,000 bbls. This is a buildup from Sept. 30, 1949, of over 33,000,000 bbls. East of California the buildup is from around 85,600,000 bbls. to 115,000,000 bbls., between 29 and 30,000,000 bbls. During the 1948-49 period from Sept. 30 to March 31 the buildup in gasoline stocks for the U. S. was close to 37,000,000 bbls. and for east of California close to 32,500,000 bbls.

Fig. 1, Runs to Stills—Close to March '49 Rate

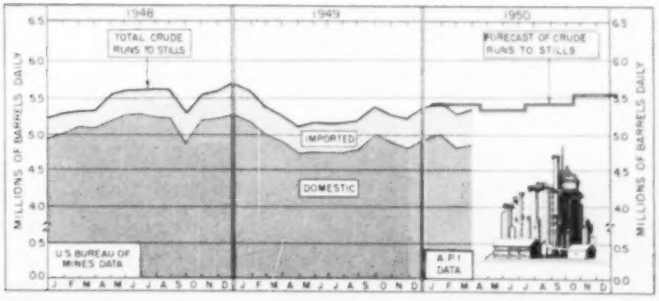

1948
1949
1950
TOTAL CRUDE RUNS TO STILLS
FORECAST OF CRUDE RUNS TO STILLS
IMPORTED
DOMESTIC
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS DAILY
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Table 1—Relationship of Heating Oil Stocks (Kerosine and Distillate Fuels) to Gasoline Stocks, End of March, 1946-1950

(1,000,000 Bbls.)

Year	Heating Oils	Gasoline
	Total U. S.	
1950	51.5	135.5
1949	69.7	127.4
1948	42.7	111.9
1947	41.2	105.4
1946	39.2	104.2
	East of California	
1950	41.5	114.8
1949	59.1	111.5
1948	30.9	90.7
1947	29.7	83.3
1946	31.9	88.9

Table 2—Relationship of Demand for Heating Oils (Kerosine and Distillates) and Motor Fuel by Years, 1945-1949, for U. S.

(1,000,000 Bbls.)

Year	Heating Oils	Gasoline
1949	445.4	952.3
1948	477.6	908.6
1947	457.9	842.3
1946	370.1	780.7
1945	341.3	784.4

Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
March '50 API*	4,869	467	5,336
March '49 BM	4,941	412	5,353
Change	−72	+55	−17
% Change	−1	+13	−0.4

* Through March 25

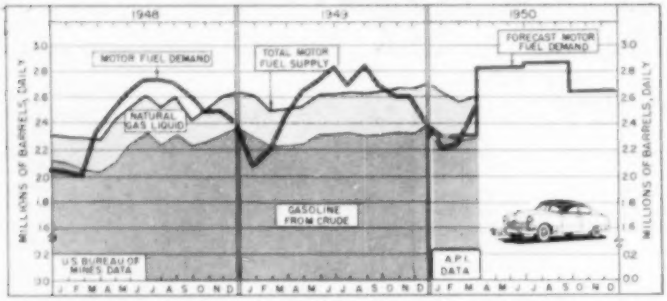
Total (1,000,000 bbls.)
(Bureau of Mines Data)

12 Mo. '49	1,796.6	144.5	1,941.1
12 Mo. '48	1,906.6	124.0	2,030.6
Change	−110.0	+20.5	−89.5
% Change	6.1	24.6	4.2

Yields on Crude Runs to Stills

	Gasoline %	Kerosine %	Dist. Fuels %	Resid. Fuels %
March '50 API	42.9	6.1	17.7	21.5
Feb. '50 API	42.9	6.5	18.6	21.7
Jan. '50 BM	42.8	6.5	18.9	21.9
March '49 BM	43.1	5.4	17.5	22.7

Fig. 2, Motor Fuel—Seasonal Upswing in Demand


1948
1949
1950
MOTOR FUEL DEMAND
TOTAL MOTOR FUEL SUPPLY
FORECAST MOTOR FUEL DEMAND
NATURAL GAS LIQUID
GASOLINE FROM CRUDE
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS, DAILY
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Natural Gas Liquids include natural gasoline blended at refineries, and used direct as motor fuel.

Fig. 3, "Gas" Stocks—6 Mos. Buildup 33,000,000 Bbls.

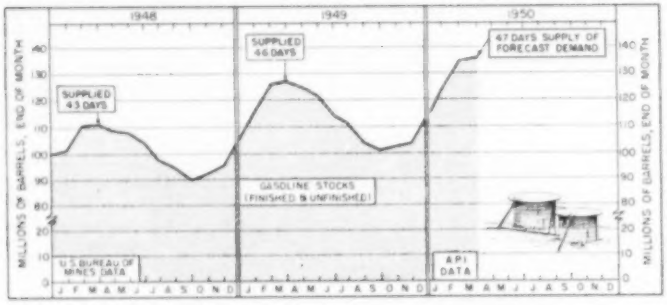

1948
1949
1950
SUPPLIED 43 DAYS
SUPPLIED 46 DAYS
47 DAYS SUPPLY OF FORECAST DEMAND
GASOLINE STOCKS (FINISHED & UNFINISHED)
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS, END OF MONTH
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Fig. 4, Heating Oils—Peak Demand in March

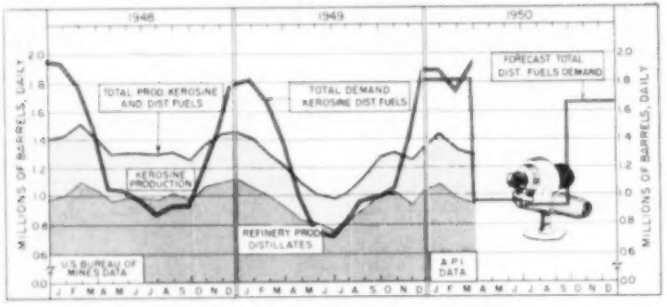
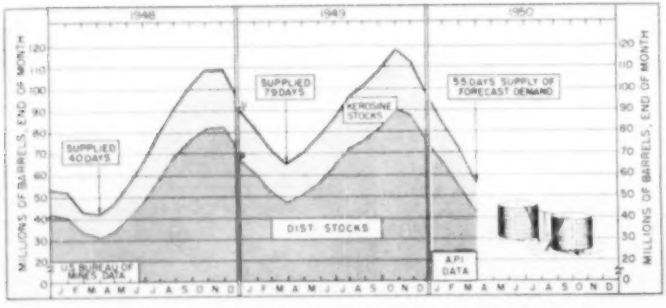

1948
1949
1950
TOTAL PROD. KEROSINE AND DIST. FUELS
TOTAL DEMAND KEROSINE DIST. FUELS
FORECAST TOTAL DIST. FUELS DEMAND
KEROSINE PRODUCTION
REFINERY PROD. DISTILLATES
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS, DAILY
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Fig. 5, Heating Oil Stocks—Below 1949 Levels


1948
1949
1950
SUPPLIED 40 DAYS
SUPPLIED 79 DAYS
55 DAYS SUPPLY OF FORECAST DEMAND
KEROSINE STOCKS
DIST. STOCKS
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS, END OF MONTH
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

* Change in reporting in California eliminated 4,500,000 bbls. from distillate classification.

Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended Used Direct	TOTAL
March '50 API*	2,390	300	2,690
March '49 BM	2,258	291	2,549
Change	+42	+9	+51
% Change	2		2

* Through March 25th operations.

Total (1,000,000 bbls.)

(Bureau of Mines Data)

12 Mo. '49	853.6	108.2	961.8
12 Mo. '48	819.7	102.2	921.9
Change	+33.9	+6.0	+39.9
% Change	4.1	5.9	4.3

Motor Fuel Demand Including Exports

Daily Average (1000 bbls.)

March '50 API*	2,585
March '49 BM	2,495
Change	90
% Change	4

* Through March 25th operations.

Total (Bbls.)

(Bureau of Mines Data)

12 Mo. '49	972,356,000
12 Mo. '48	908,572,000
Change	+63,784,000
% Change	4.8

Gasoline Stocks

(Bbls. finished and unfinished, end of month)

March '50 API*	135,400,000
Feb. '50 API	134,000,000
Jan. '49 BM	125,208,000
March '49 BM	127,442,000

* On March 25th.

Heating Oils Production

(Kerosine and Distillates)

Daily Average (1000 bbls.)

	Kero-sine	Dist. Fuels	TOTAL
March '50 API*	326	952	1,278
March '49 BM	289	933	1,222
Change	+37	+19	+56
% Change	13	2	4

* Through March 25th operations.

Total (1,000,000 bbls.)

(Bureau of Mines Data)

12 Mo. '49	102.1	339.5	441.6
12 Mo. '48	121.9	380.7	502.6
Change	—19.8	—41.2	—61.0
% Change	16.2	10.8	12.1

Heating Oils Demand

Daily Average (1000 bbls.)

	Kero-sine	Dist. Fuels	TOTAL
March '50 API*	447	1,106	1,553
March '49 BM	327	1,102	1,429
Change	+120	+4	+124
% Change	37	36	36

* Through March 25th operations.

Total (1,000,000 bbls.)

(Bureau of Mines Data)

12 Mo. '49	105.1	340.2	445.3
12 Mo. '48	115.7	361.9	477.6
Change	—10.6	—21.7	—32.3
% Change	9.1	6.0	6.7

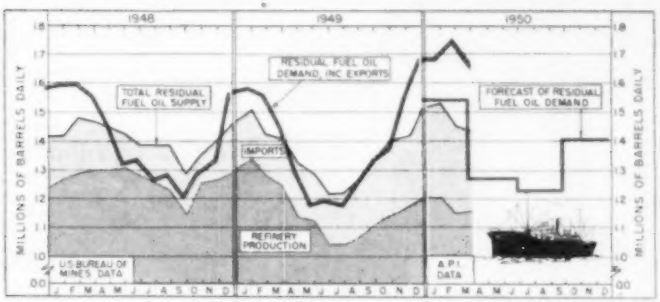
Heating Oil Stocks

(1,000,000 bbls. end of month)

	Kero-sine	Dist. Fuels	TOTAL
March '50 API*	12.9	40.3	53.2
Feb. '50 API	15.9	54.2	70.1
Jan. '50 BM	18.3	63.9	82.2
March '49 BM	17.8	48.9	66.7

* On March 25th.

Fig. 6, Residual Oils—Demand Drops in March



Residual Fuels Production

Daily Average (1000 bbls.)

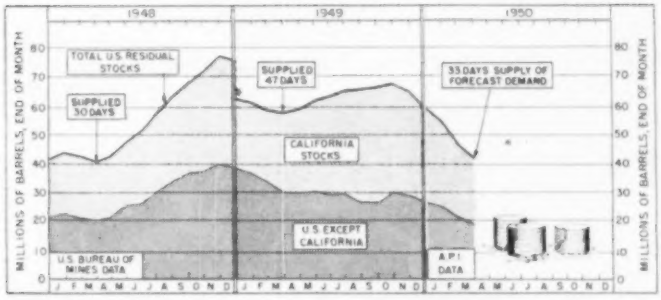
	Refinery Output	Imports	TOTAL
March '50 API*	1,142	300	1,442
March '49 BM	1,258	159	1,417
Change	−116	+141	+25
% Change	9	78	2

* Through March 25th operations.

Total (1,000,000 bbls.)
(Bureau of Mines Data)

12 Mo. '49	424.8	74.5	499.3
12 Mo. '48	466.5	53.2	519.8
Change	−41.7	+21.3	−20.2
% Change	8.9	40.0	3.9

Fig. 7, Residual Stocks—Lowest in Two Years



* Change in reporting in California eliminated 13,000,000 bbls. from residual classification

Residual Fuels Demand

Daily Average (1000 bbls.)

March '50 API*	1,653
March '49 BM	1,469
Change	183
% Change	13

* Through March 25th operations.

Total Demand (bbls.)

12 Mo. '49	507,962,000
12 Mo. '48	513,554,000
Change	−5,592,000
% Change	1.1

Residual Fuels Stocks

(Bbls. end of month)

	U.S. Except California	Total U.S.
March '50 API*	19,500,000	42,550,000
Feb. '50 API	22,100,000	47,800,000
Jan. '50 BM	25,700,000	55,800,000
March '49 BM	30,800,000	58,200,000

Fig. 8, Production and Demand of Natural Gas Liquids

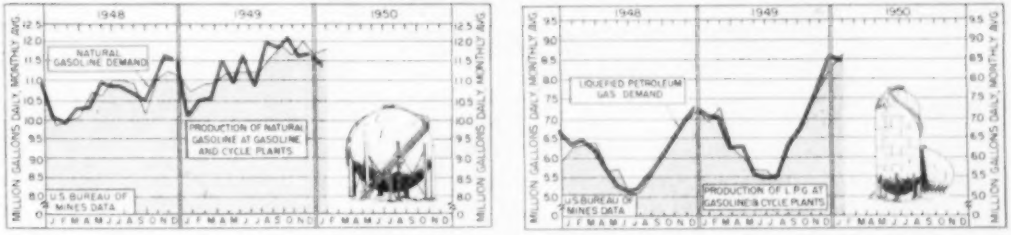
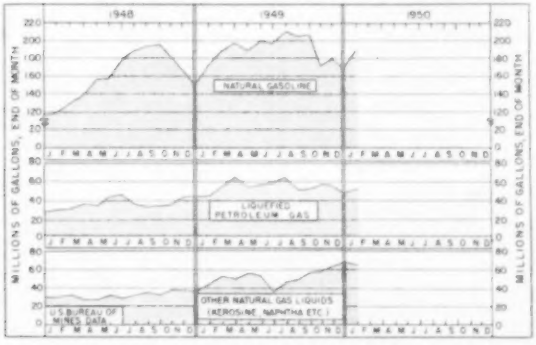

1948
1949
1950
MILLION GALLONS DAILY MONTHLY AVG.
NATURAL GASOLINE DEMAND
PRODUCTION OF NATURAL GASOLINE AT GASOLINE AND CYCLE PLANTS
LIQUEFIED PETROLEUM GAS DEMAND
PRODUCTION OF L.P.G. AT GASOLINE & CYCLE PLANTS
U.S. BUREAU OF MINES DATA
J F M A M J J A S O N D

Fig. 9, Stocks of Natural Gas Liquids


1948
1949
1950
MILLIONS OF GALLONS, END OF MONTH
NATURAL GASOLINE
LIQUEFIED PETROLEUM GAS
OTHER NATURAL GAS LIQUIDS (KEROSINE NAPHTHA ETC.)
U.S. BUREAU OF MINES DATA
J F M A M J J A S O N D

Natural Gas Liquids Statistics

(Source: U. S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Production (1000 gal./day avg.) Natural Gasoline	LPG**	TOTAL	Demand* (1000 gal./day avg.) Natural Gasoline	LPG	TOTAL
Jan. '50	11,417	8,600	20,017	11,438	8,574	20,012
Jan. '49	10,700	6,900	17,600	10,260	7,000	17,260
Change	+1,117	+1,700	+2,817	+1,178	+1,574	+2,752
% Change	11	25	16	11	22	16
	Total Production (1000 gal.)			Total Demand (1000 gal.)		
12 Mo. '49	4,142,110	2,418,436	6,560,546	4,168,753	2,433,596	6,602,349
12 Mo. '48	3,953,216	2,209,071	6,162,287	3,966,763	2,237,531	6,204,294
Change	+188,894	+209,365	+398,259	+201,990	+196,065	+398,055
% Change	4.8	9.5	6.5	5.1	8.8	6.4

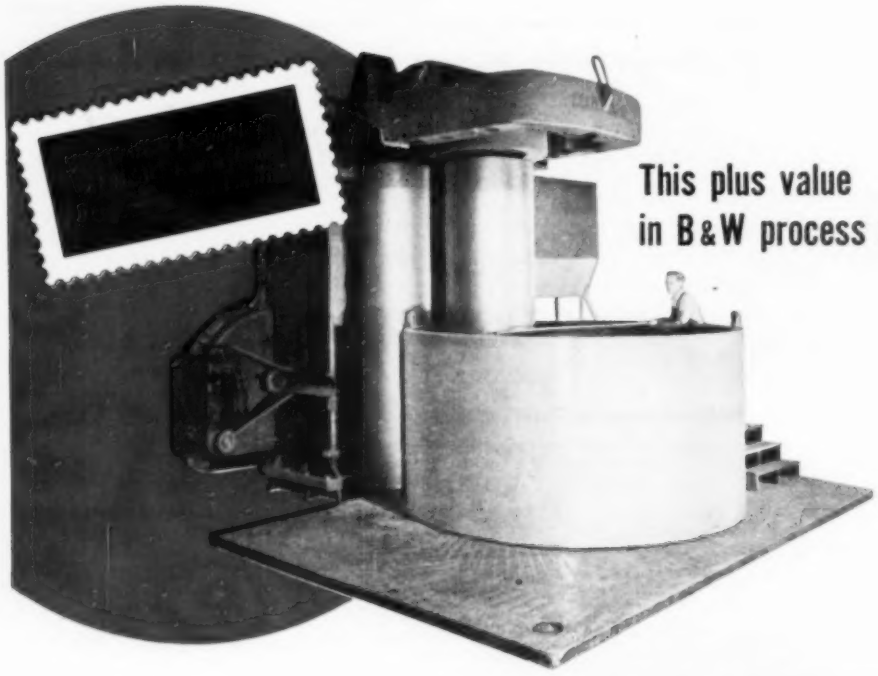
Stocks, End of Month (1000 gal.)

	By Type of Product: Natural Gasoline	LPG	Other Products†	By Location: Refineries	Gasoline Plant	TOTAL
Jan. '50	191,132	55,183	64,920	85,974	225,275	311,249
Dec. '49	172,207	49,228	61,413	81,228	205,660	286,888
Jan. '49	170,121	46,582	44,629	68,376	192,756	261,132

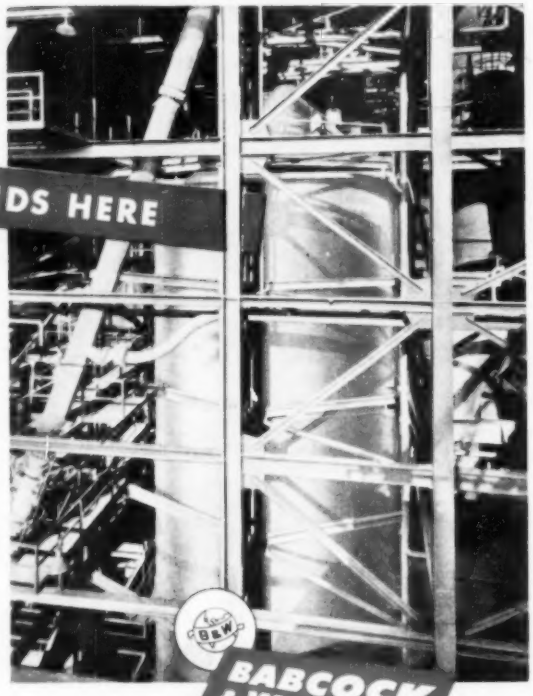
* Demand, including exports but not transfers, is supplied from receipts from outside sources as well as current production and stock changes. Outside receipts totaled 17,588,000 gals. in January.

** Does not include LPG produced at refineries which in January totaled 10,928,000 gals.

† Includes kerosine, naphtha, specialty and other products.



This plus value in B&W process equipment



PAYS DIVIDENDS HERE

One of many extra values inherent in B&W refinery vessels is their perfect symmetry and freedom from localized stresses. Not only are the sections thoroughly annealed after welding, but in addition, are re-rolled to remove flatness at the welded seam, which otherwise would increase local stress as much as 10%. Such painstaking engineering, together with long, diversified experience and unexcelled fabricating facilities make B&W a leading source of refinery processing vessels that pay dividends in long, dependable, trouble-free service. The Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.

BABCOCK & WILCOX

5-91

NEWS OF

Manufacturers—Suppliers—Engineering Firms

Serving the Petroleum Processing Industry

Babcock & Wilcox Installs Alloy Creep Test Apparatus at Alliance Laboratory

Group of four 12-station stress rupture test units in Babcock & Wilcox' new Alliance laboratories

Alloy research equipment designed to investigate creep and stress rupture phenomena has been installed in the new research and development laboratory of Babcock & Wilcox Co. in Alliance, Ohio. Some of this apparatus was developed at the Massachusetts Institute of Technology as the result of a joint fellowship established by B&W Co. and the B&W Tube Co. in 1926, and under the direction of Professor F. H. Norton.

Many alloy steels now used in petroleum refining, chemical processing, and power generation were tested and proved with the M. I. T. equipment, now being used at the Alliance laboratories. Twenty creep test units, using multiple-circuit electronic controls, make it possible to hold temperatures within plus or minus one degree F. up to 1550° F. Using a 10-in. test specimen, a change of less than 10 micro-inches in the length of the test bar can be measured.

For studying stress-rupture characteristics of metals, four special 12-station units have been built at Alliance, shown in the photograph. The total capacity of the laboratory now makes it possible to perform 36 creep tests and 48 stress rupture tests, or 84 stress rupture tests, simultaneously.

Kellogg Cuts Prices on KEL-F

M. W. Kellogg Co. has reduced the orignal price of its new fluorocarbon-type thermoplastic material, "KEL-F," about 50% according to a new price scale. For example, 100 lbs. of low-density molding powder now costs $13.75/lb., as compared with the original cost of approximately $26/lb. The reduction has resulted from the increasing acceptance and use of the product in so many different industries, Kellogg stated.

Quaker Rubber Opens in Pittsburgh

Quaker Rubber Corp., now a division of H. K. Porter Co., Inc., has opened a new stock-carrying branch at 311 First Avenue, Pittsburgh. The new branch is under the direction of H. M. Sossaman, who was assistant general sales manager for Quaker before his appointment to the new position. The Pittsburgh location will carry a complete inventory of industrial rubber products and will serve customers in western Pennsylvania, eastern Ohio, and West Virginia.

Johnston & Jennings Purchased

The Pettibone Mulliken Corp. of Chicago has purchased the Johnston & Jennings Co. of Cleveland, including its Oceco Div., vent valves, flame arrestors, gages, swing lines, and other tank equipment. The entire finished inventory, including work in process, records, etc., have been moved to the Chicago plant at 4710 West Division St., Chicago 51. Sales representation continues practically unchanged. The company will be known as: The Johnston & Jennings Co., division of Pettibone & Mulliken Corp.

Fluor Corp. Promotes Three

The Fluor Corp. Ltd., Los Angeles, has announced promotion of three of its personnel to higher positions in the company. James G. DeFlon, engineer with the firm since 1941, has been assigned duties in the New York sales office. This is following his return from London, where he completed details of the company's agreement with Head Wrightson Processes Ltd. The agreement paves the way for the sale of Fluor products and services in the Sterling and other European areas. Mr. DeFlon reports that cooling tower installations are under way for British Petroleum Chemicals in Grange Mouth, Scotland; for Philbloc Ltd. at Avon Mouth, England; and for Socony-Vacuum at Gravenchon, near Le Havre, France.

Mr. DeFlon

Mr. Weidlien

Mr. McKay

Lee Weidlien, engineer in the Los Angeles sales office from 1943 to 1948, recently rejoined the company to take charge of sales in the San Francisco office. Jack E. McKay,

advertising manager, was advanced to sales engineer in the Houston office. Prior to his post in advertising, Mr. McKay was sales engineer in Kansas City and Los Angeles.

Socony Paint Promotes Walters

Fred A. Walters, assistant general manager in charge of manufacturing of Socony Paint Products Co., Metuchen, N. J., has been promoted to vice president of the organization, succeeding C. G. Nelson, who retired January 1.

Mr. Walters started in 1912 with the Standard Oil Co. of New York as a stenographer and statistician in the export department. He spent nine years in China in charge of manufacturing and installation. He returned to this country as a buyer for Socony-Vacuum Oil Co. Inc., and was transferred to the paint division in 1942.

Crosby Steam Moves to Wrentham

Crosby Steam Gage & Valve Co. has moved to its new home at Wrentham, Mass., a plant containing over 100,000 sq. ft. of floor space and newly equipped with modern machinery. The Ashton Valve Co., under the same ownership and management as Crosby, also has moved to the Wrentham plant, combining the manufacturing operations of the two companies.

Crosby's new Western Union teletype code number is WUX Wrentham. A direct telephone wire connects the factory, Wrentham 248, with the Boston sales office, SOmerset 6-7240.

Harry Smith Joins Ohio Injector

Mr. H. G. Smith

Harry G. Smith has been appointed vice president and director of sales for Ohio Injector Co., Wadsworth, Ohio. He comes to OIC from the A. O. Smith Corp., Los Angeles, where he was manager in charge of administration, sales, manufacturing, and engineering of the meter division.

Mr. Smith has been associated with the oil industry for 13 years, beginning his career as a research engineer for Smith Meter Co., a former subsidiary of A. O. Smith, progressing through engineering and sales departments to vice president and general manager. As a member of the joint ASME-API fluid measurement committee, he assisted in the preparation of the Code on Positive Displacement Meter Measurement.

B&W Moves Lefferty to West Coast

H. F. Lefferty has been named Pacific Coast sales manager of Babcock & Wilcox Tube Co., succeeding H. P. Curtis who has resigned to enter other activities. With the firm for 33 years, Mr. Lefferty most recently was district sales manager at Chicago. His new headquarters will be in the Petroleum Bldg., 714 Olympic Blvd., Los Angeles.

Austin Moves Heavy Vessels on Snow

The Austin Co. recently solved a problem of installing four 40-ton, eight foot diameter by 70 ft., 30,000-gal. gas storage tanks at the Midland, Mich. plant of Dow Chemical Co. Three flatcars were required to transport each tank from the Chester, Pa., plant of Sun Ship Building Co. to Midland.

The main problem was to move the vessels from the railway siding to the point of installation about ½ mile. Realizing that the coefficient of sliding friction would be reduced from an estimated 0.2 for dry ground to 0.02 for snow, Austin engineers

How to Keep COST DOWN on Valve Maintenance

Cleaning one valve before overhaul won't amount to much in time or money, that's true! But multiply that one valve by thousands—at year's end your expenditure will be pretty high.

If your valve maintenance-cleaning runs into big money, we believe we can help you hold your costs way down. We believe (and many refiners will agree) that Oakite Steam-Detergent cleaning with the Oakite Solution-Discharging Steam Gun will prove infinitely superior to manual scrubbing . . . ON ALL COUNTS. It's quicker, more efficient and decidedly more economical.

Oakite Steam-Detergent cleaning is a lead-pipe cinch to install. All you need is the Oakite Gun, plus 30 lbs. steam pressure; a couple of lengths of rubber hose, and an old steel drum for your cleaning solution. You need no motor, no injector, no pump.

And the beauty of Oakite Steam-Detergent cleaning is that you can reach those hard-to-get-at places. You can use it on all kinds of equipment. You can strip paint with it.

Free 8-page folder gives all the facts on Oakite Steam-Detergent cleaning. Get yourself a copy today. No obligation.

OAKITE PRODUCTS, INC., 37 Thames St., NEW YORK 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE

TRADE MARK REG. U. S. PAT. OFF.

PETROLEUM SERVICE DIVISION

[*To obtain more data on advertised products see page 424*]

decided to wait for a predicted early snow. After the snow had fallen, the tanks were lowered to the ground and dragged to the point of installation, a Caterpillar tractor pulling and a Lorain motor crane pushing each one.

Harris Up at Cameron Iron Works

Cameron Iron Works of Houston has appointed Jack Harris sales manager of the newly created "LP" Valve Division. For the past several years, he has been in Cameron's engineering and sales departments. He came from J. S. Abercrombie-Harrison Oil Co.'s refinery at Sweeny, Texas, where he was a department head. Prior to that time he was a foreman at Gulf Oil's Port Arthur refinery, after receiving a B. S. in Chemical Engrg. from Rice Institute in 1935.

Mr. Harris

Mr. Bliss

At the same time, Cameron also announced the appointment of Ames Bliss to sales engineer for the "LP" Valve Division. Mr. Bliss, a graduate of Massachusetts Institute of Technology, has worked under Mr. Harris on development of the new Cameron Lift-Plug Valve.

Personnel Changes

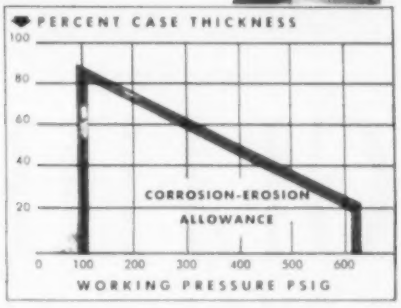
Solvay Sales Division, Allied Chemical & Dye Corp.—Harold F. Merritt, a vice president for the past 19 years, has been appointed executive vice president responsible for the direction of all activities.

Brown Instruments Co.—John B. Moxness has been appointed industry engineer in charge of sales promotion of control devices.

Kerotest Mfg. Co.—E. T. Adams has been appointed district manager of oil country valve sales in the Houston territory. He had been director of purchases and head of production control in the home offices at Pittsburgh.

Manning, Maxwell & Moore, Inc.—Colby M. Chester, a director for 20 years, has been elected chairman of the Board. Robert R. Wason was re-

Nothing is left to chance...



when you specify

Pacific *Precision Built*

HEAVY DUTY PROCESS PUMPS

. . . pumps that are custom built to provide a more-than-adequate margin for safe operation even where high pressure, extreme temperature and corrosion, may all be predominant factors. The chart illustrates graphically the margin of safety that Pacific builds into Process Pumps. For example: Chart above for a large pump shows that at 625 PSIG working pressure and 800° F. temperature a 20% margin of safety is provided; at 300 PSIG a 61% margin of safety is provided at the same temperature. Other readings are clearly indicated. Thus your choice is proved sound before your okay to purchase a Pacific Process Pump appears on the specifications.

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES
HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York
Offices in All Principal Cities

PACIFIC *Precision Built* PUMPS

PR-11

[*To obtain more data on advertised products see page* 424]

elected President. Mr. Chester takes the position of the late C. A. Moore.

The Marley Co., Inc.—James W. Elizardi, previously associated with Griscom-Russell, has been made manager of the Houston sales office.

Expansion, Transition

Dravo Corp., Pittsburgh, has announced purchase of a large pipe fabricating plant at Marietta, Ohio formerly owned by International Derrick Co. The property consists of two manufacturing buildings, storage yards and an office, and comprises 93,000 sq. ft. of floor space. Operation of the new plant will follow purchase and installation of equipment.

Construction has been started on a plant addition valued in excess of $100,000 at **General Controls'** Glendale, Calif., plant. The new facilities will be devoted to assembly operations of automatic pressure, temperature, level, and flow controllers.

Black, Sivalls & Bryson, Inc., have purchased all the assets of the company formerly known as **Climax Engrg. Co., Controls Div.** The business will be continued under the official name of Black, Sivalls & Bryson, Inc., Climax Controls Div. There will be no changes in personnel, and the products distributed by Climax in the past will continue to be manufactured in Tulsa.

General Refractories Co. has entered into a contract to purchase all outstanding capital stock of **American-Austrian Magnesite Corp.** of Pittsburgh, who own and operate magnesite deposits and a refractory brick plant near Radenthein, Austria. Acquisition is scheduled for completion by this Spring.

Branches, Distributors

Warner Lewis Co.—Richard Morton, a registered chemical engineer with many years' experience with refiners and refinery engineering firms, has been named New York representative. His office is at 30 Church St., New York 7, telephone is REctor 2-3162.

Bigelow-Liptak Corp.—Two new offices have been established with the following personnel in charge: Charles F. Koos in Tulsa, to cover Oklahoma, New Mexico, and parts of Texas and Arkansas; and Armin O. Schleiffarth in St. Louis, to cover eastern Missouri and southern Illinois.

Alloy Steel Products Co., Linden, N. J., has announced the appointment of the following concerns as distributors: Republic Supply Co. of Calif., 1401 Park Ave., Emeryville 8, Calif., and 2600 So. Eastland Ave., Los Angeles 54; Railway and Power Engrg. Corp. Ltd., 169 Eastern Ave., Toronto 2, Ont. A manufacturers' agent in Utah, Southern Idaho, Wyoming, and Colorado is Wetzel Equipment Agency, 375 South West Temple, Salt Lake City, Utah.

Refiners Report . . .

Superior

LUBE OIL, FUEL OIL, GREASE, GASOLINE

through the use of

GLIDDOL

by **Glidden,** *Pacemaker in Soya Research*

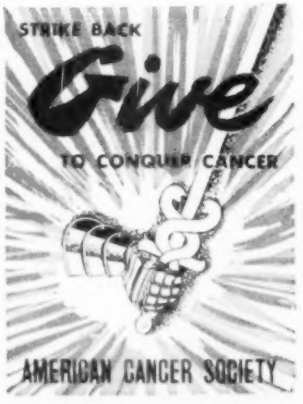
Many refiners have already discovered how Gliddol—the scientifically processed soybean derivative by Glidden—reduces surface tension to promote the thorough blending of oil or grease and additives. And from the combined evidence of laboratory tests and the experience of users, they report that this ideal blending agent and inhibitor gives greater protection to engine parts by effectively checking oxidation . . . gives oil and grease a longer life of usefulness by dispersing all insoluble solids.

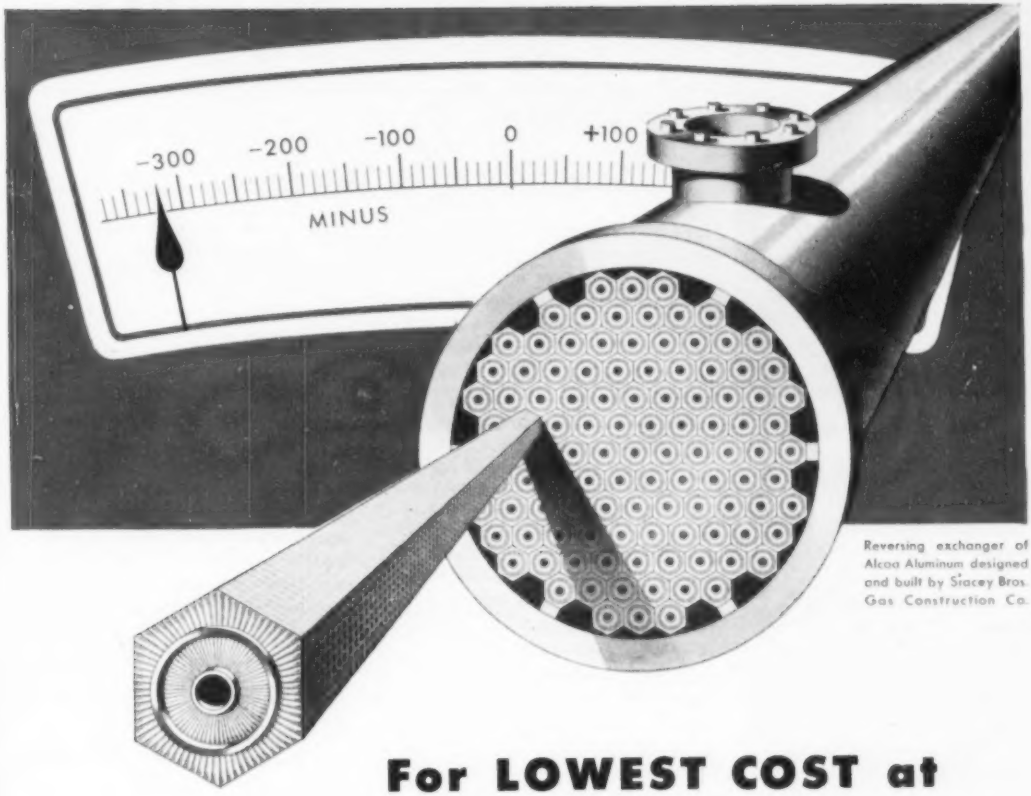
In the role of protective colloid, Gliddol prevents the formation of any precipitate in leaded and unleaded gasoline—retards deterioration on exposure of the fluid to sunlight. Gliddol R, a special Gliddol product, slows up the darkening of fuel oil and reduces the formation of precipitate in the presence of heat.

Expert guidance on the use of Gliddol and Gliddol products to improve your product is offered without obligation by the Technical Service of Glidden—Pacemaker in Soya Research. Your inquiry is invited.

QUALITY Glidden PRODUCTS

The Glidden Company
SOYA PRODUCTS DIVISION
5165 West Moffat Street
Chicago 39, Illinois





Reversing exchanger of Alcoa Aluminum designed and built by Stacey Bros. Gas Construction Co.

For LOWEST COST at minus 320° F

Take your choice of metals suitable for sub-zero process equipment . . . copper, nickel, stainless, aluminum. All stay strong as temperatures drop. All are fabricated by standard tools and methods.

But here the similarity ends. Alcoa Aluminum costs less . . . less to buy . . . less to design . . . less to fabricate.

Take advantage of Alcoa's test results, fabrication help and service records. Call your local Alcoa sales office, or write ALUMINUM COMPANY OF AMERICA, 1477D Gulf Bldg., Pittsburgh 19, Pa.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

INGOT • SHEET & PLATE • SHAPES ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT-MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

ADVERTISERS' INDEX

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card. . .no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

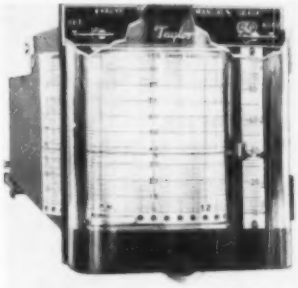
(A) ALLIED CHEMICAL & DYE CORP. ..... Inside Back Cover
(B) ALUMINUM CO. OF AMERICA... 341
(C) ALUMINUM CO. OF AMERICA .. 423
(D) ALUMINUM CO. OF AMERICA .. 396
(E) ALUMINUM CO. OF AMERICA .. 323
(F) AMERICAN CYANAMID CO. 315
(G) AMERICAN DISTRICT STEAM CO. 426
(H) AMPCO METAL, INC. 332, 333
(I) ARCO CO., THE 328
(J) ATLAS MINERAL PRODUCTS CO. 402
(K) ATTAPULGUS CLAY CO 331
(L) BABCOCK & WILCOX TUBE CO., THE 322
(M) BABCOCK & WILCOX TUBE CO., THE 415
(N) BADGER, E. B. & SONS CO. 348, 349
(O) BAKER & ADAMSON Inside Back Cover
(P) BETHLEHEM STEEL CO. 408
(Q) BETZ, W. H. & L. D. 439
(R) CALUMET HECLA CONSOLIDATED 433
(S) CAREY, THE PHILIP MFG. CO .. 407
(T) CARRIER CORP. 329
(U) CHICAGO BRIDGE & IRON CO. .. 340
(V) CLARK MFG. CO. 395
(W) CONSOLIDATED ENGINEERING CORP. 435
(X) CONTINENTAL SUPPLY CO. 392, 393
(Y) CRANE CO., THE 336
(Z) CRANE PACKING CO. 434
(AA) DAVISON CHEMICAL CORP. ... 379
(AB) DU PONT DE NEMOURS & CO. INC., E. I. .....Facing Page 344
(AC) DU PONT DE NEMOURS & CO., INC., E. I. 316
(AD) ELECTRIC AUTO-LITE CO., THE 438
(AE) ETHYL CORP. 313
(AF) FLUOR CORP., LTD. 426
(AG) FOSTER WHEELER CORP. ..... Facing Page 408
(AH) FONBORO CORP., THE 400
(AI) GENERAL AMERICAN TRANSPORTATION CORP. 314
(AJ) GENERAL AMERICAN TRANSPORTATION CORP. 437
(AK) GENERAL CHEMICAL DIV. ..... Inside Back Cover
(AL) GLIDDEN CO., THE 422
(AM) GLOBE STEEL TUBES CO. ... 386
(AN) GRAVER TANK & MFG. CO. .. 345
(AO) GREENE, TWEED & CO. 431
(AP) GRISCOM-RUSSELL CO. 346, 347
(AQ) HARTZELL PROPELLER FAN CO. 395
(AR) HOPKINS' VOLCANIC SPECIALTIES 408
(AS) HUDSON ENGINEERING CORP. ..... Inside Front Cover
(AT) JERGUSON GAGE & VALVE CO. 383
(AU) KELLOGG CO., M. W., THE ... . Facing Page 376
(AV) KELLOGG CO., M. W., THE 324
(AW) LUMMUS CO. .. Facing Page 328
(AX) MATHIESON CHEMICAL CORP., 414
(AY) MIDWEST PIPING & SUPPLY CO. INC. 405
(AZ) MONSANTO CHEMICAL CO. .. 327
(BA) NATIONAL AIROIL BURNER CO. 429
(BB) NATIONAL FOAM SYSTEM, INC. 342
(BC) NORDSTROM VALVE DIV. 338, 339
(BD) OAKITE PRODUCTS, INC. 420
(BE) OIL WELL SUPPLY CO. 350
(BF) PACIFIC PUMPS INC. 421
(BG) PENBERTHY INJECTOR CO. .. 317
(BH) PETRO-CHEM DEVELOPMENT CO., INC. 350
(BI) PETROLEUM RECTIFYING CO. .. 344
(BJ) POWELL CO., WM., THE 411
(BK) PRECISION SCIENTIFIC CO. .. 430
(BL) % PROPORTIONEERS, INC. % ... 321
(BM) RIDGE TOOL CO., THE 410
(BN) ROCKWELL, W. S. CO. 431
(BO) ROOTS-CONNERSVILLE BLOWER CORP 432
(BP) SHELL OIL CO., INC. 343
(BQ) SOLVAY SALES DIV. OF ALLIED CHEM. & DYE CORP. 337
(BR) SPENCER CHEMICAL CO. 429
(BS) SUN SHIPBUILDING & DRYDOCK CO. 403
(BT) TRETOLITE CO. 334
(BU) UNIVERSAL OIL PRODUCTS CO. 412, 413
(BV) UNIVERSAL OIL PRODUCTS CO. 427
(BW) WARREN PETROLEUM CORP., 330
(BX) WEDGEPLUG VALVE CO., INC. 429
(BY) WESTERN SUPPLY CO. 335
(BZ) WOLVERINE TUBE DIV. 433
(CA) WYATT METAL & BOILER WORKS ..... Outside Back Cover
(CB) YARNALL-WARING CO. 438

What's New!

EQUIPMENT . . . MATERIALS . . . PROCESSES . . . LITERATURE

Reviewed by WILLIAM C. UHL, Equipment Editor

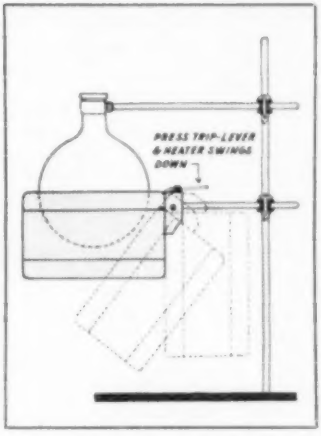
New Recorder with 3-in. Strip Chart Designed for Use on Graphic Panels



The Taylor "Transet" Recorder is a new miniature recording-receiving instrument designed specifically for use on the new graphic-type or conventional control panels. It is a compact unit which will fit into a panel opening 3⅞ x 4½ in., with a flange measurement of 4½ x 5 in. When the full-view plastic door is opened, adjustments can be made. The left top lever provides for instant checking of valve position. The right lever permits changing from automatic to manual control. Two screws above this lever are the micrometer zero adjustments for set-pointer and pen. Scale at the right is marked to show 3 to 15 psig. range, helpful for noting valve position and for calibrating. The recorder has a 30-day strip chart with vertical time lines. It is about 3 in. wide and has 100-line graduations evenly divided. It is also available as a 0 to 10 square root chart. The chart discharges from the side at 1 in./hr. and it can be torn off at the side or front. Since it runs from right to left, it produces a record similar to one which would be plotted by a process engineer. The chart and the motor drive is designed to pull out like a camera. Taylor Instrument Cos.

Check No. **1** *on Reply Card*

Laboratory Flask Heater Offered In Clamp-mounted "Swing-Away" Models



A new line of laboratory heaters, using ribbon-type electrical elements, features a "Swing-Away" Model designed especially for distillation column set-ups which require heating jackets which can be quickly removed without disturbing the column or the flask. The 200 Series "Form-A-Heater" (illustrated in the sketch) can be swung down from its position around the flask by pressing a lever. It is furnished with or without clamp. Heaters are also supplied in a standard line where the heater provides support for the flask. Five sizes give capacities of 1000, 2000, 3000, 5000, and 12,000 ml. in both models. Reco.

Check No. **2** *on Reply Card*

One-Man Platform Hoist Is Operated By Bicycle Pedals, Has Safety Stops

The "Bosun's Chair" is a tubular steel, one-man, foot-operated platform hoist for painting, maintenance, and repair work on large tanks, vertical walls, stacks, and the like. Sitting on a bicycle-type saddle, the workman operates standard bicycle pedals to raise or lower the cage. Movement up or down may be as fast as 25 ft./min. With a rated capacity of 625 lbs., the chair weighs only 75 lbs., and is furnished with 150 ft. of ¼-in., 6 x 19 plow steel wire rope. Two hard rubber rollers on the front of the unit prevent marring working surfaces. An expanded steel bottom deck permits carrying considerable equipment, prevents objects from falling, and allows the workman to stand up if desired. A mechanical brake in the crankshaft gives positive braking action whenever pedal rotation stops. In addition, a pawl engages the drum ratchet and must be disengaged manually before descent is possible. Finally, an automatic stop prevents turning of the crankshaft in the lowering direction until disengaged manually. Safway Steel Products, Inc.

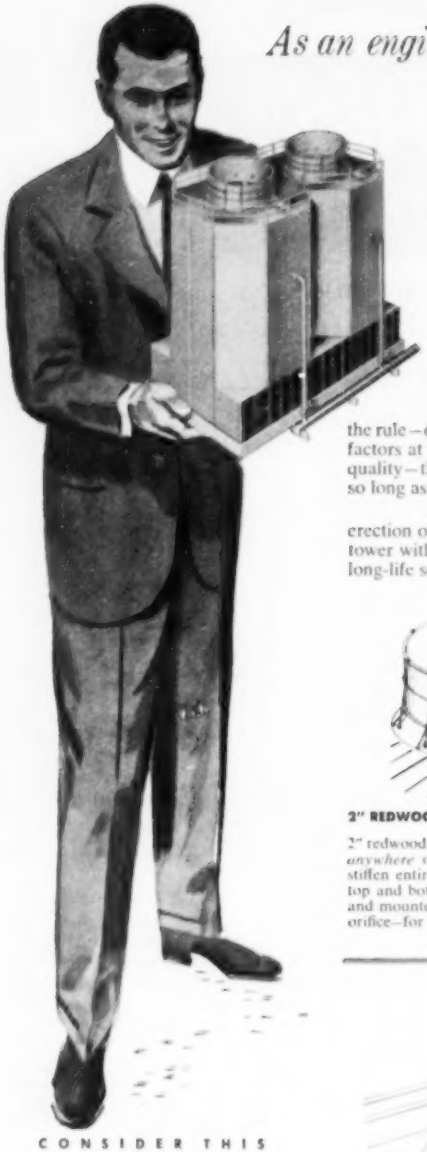
Check No. **3** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional information or literature on any items reviewed in "What's New!" Just check the numbers corresponding to the numbers on the items you're interested in, fill in the rest of the card, and drop it in the mail. No postage required.

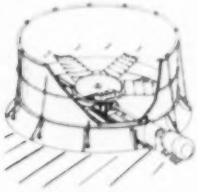
As an engineer you will appreciate...

The RUGGED DESIGN inherent in the 1950 FLUOR COUNTERFLO Cooling Tower



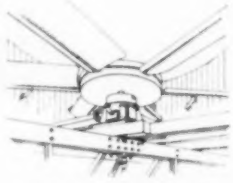
Ruggedness is a prerequisite in cooling tower design and performance. Without it, inefficiency and costly maintenance becomes the rule—drop in plant production is the end result. Regardless of the influencing factors at time of purchase—low first cost, claims of efficiency or statement of quality—the cooling tower you select will meet performance requirements *only* so long as its original structural design endures.

Thirty years' intensive development in the design, fabrication and erection of cooling towers enables Fluor to offer you a better cooling tower—a tower with comparable first cost, the highest obtainable efficiency and rugged, long-life service.



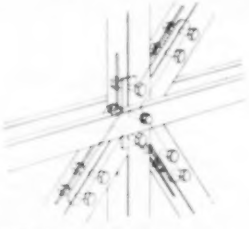
2" REDWOOD IN FAN DECK and STACK

2" redwood supports 1000#/sq. ft. load *anywhere* on deck—heavy enough to stiffen entire structure. Stack is ringed top and bottom with heavy angle iron and mounted on a metal bell-mouthed orifice—for safety and savings in power.



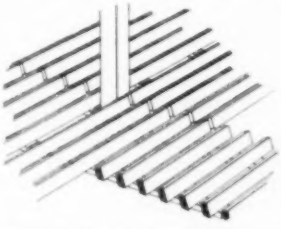
RUGGED GEAR UNIT and FAN BLADES

Gear unit is designed *specifically* for cooling tower service. Result: Less than ¼ of 1% replacement parts!
Heavy Stainless Steel Fan Blades give a larger moment of inertia—tips are strong enough to hold a man's weight.



STRONGER STRUCTURAL DESIGN

Internal gusset plate and bolt-type joints enable structural members to take *both* tension and compression loads—a design *in accordance* with the rigid requirements of major city codes and recent findings of the U. S. Forest Products Laboratory.



1" REDWOOD GRID DECK FILLING

Grid decks consist of heavy 1" redwood nailed individually on sturdy cleats—strong enough for use as scaffolding during tower erection, durable enough to permit repeated removal for cleaning or fire hosing without removing from tower.

CONSIDER THIS *about*

"Guaranteed Performance"

Fluor's "Guarantee of Performance" is based on a true bid to meet specified performance requirements. There is an old saying, "You can't get something for nothing." This is particularly true in the purchase of cooling towers—a bid allowing performance to be off only 2 or 3 degrees on the approach may seem insignificant at time of purchase, but it can mean as much as 30 to 40% difference in the size of tower necessary to do the specified job! Often this is overlooked if a tower is purchased on price alone.

For your protection compare the probable performance of the towers offered before making a decision. Analyze your cooling tower bids thoroughly!

FLUOR

BE SURE WITH FLUOR

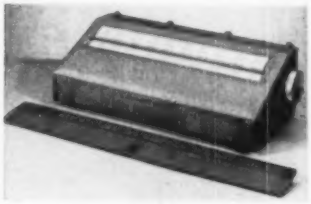
Technical Papers for Your Files: "Cooling Tower Studies," "Cooling Tower Maintenance," "Evaluating Cooling Tower Performance."

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

THE FLUOR CORPORATION, LTD., 2500 S. Atlantic Blvd., Los Angeles 22, Calif. Offices in principal cities in the United States

REPRESENTED IN THE STERLING AREAS BY: Head Wrightson Processes Ltd., Teesdale House, Baltic Street, London, E.C.1., England

Temperature Corrections Obtained Quickly with Small Roll-Chart Guide



Proper temperature coefficients for correcting oil volumes to 60° F. can be quickly determined in a new rolling chart device, which provides for rapid changes to various scales. The section of the scale which is desired is visible through a window opening. The guide is small enough to be used on a desk. All factors from 0 to 499° F. are covered, as well as seven groups of specific gravities up to 99.9° API. The factors are those reflected in the Abridged Volume Correction Table for Petroleum Oils, published in the Bureau of Standards Supplement to Circular C-410. Rollo-Guide Co.

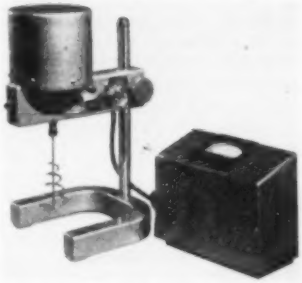
Check No. 4 on Reply Card

Static Pressure Generator Develops 23,000 psi. from 90 psi. Plant Air

Static pressure testing of vessels, piping systems, or for laboratory destruction tests where extremely high pressures are involved, is possible with a new, portable, air-operated hydraulic pressure generator. It will develop up to 23,000 psi. using air line pressures up to 90 psi., and draws oil from a built-in supply reservoir. Pressures can be present with a regulator valve. Discharge pressures are indicated on a large, direct reading dial gage. The air operation assures safety in potentially explosive atmospheres where electric motor driven equipment would be hazardous. The unit weighs 80 lbs. and is mounted on a two-wheel, rubber-tired, under-carriage. Maintenance consists of adding ordinary oil to an automatic lubricating unit. Cooper-Bessemer Corp.

Check No. 5 on Reply Card

Potentiometric Viscosimeter Measures Gels, Polymers, Thixotropic Materials



Designed particularly for the measurement of thixotropic, gel, or polymerizing substances, the Potentiometric Viscosimeter is an electrical instrument which eliminates the use of mechanical clutches and linkages. It is said to be adaptable for laboratory research or continuous plant operation, and can be used in conjunction with any potentiometric recorders. When used for gel-time studies, it provides automatic stop at maximum deflection. There is an additional outlet for intermittent timer when it is used in studies of thixotropic or congealing materials. Emil Greiner Co.

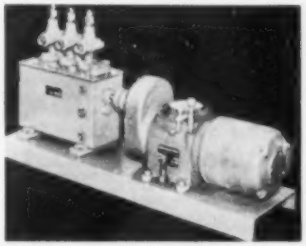
Check No. 6 on Reply Card

pH and Titration Values Measured With New AC Line-operated Unit

The "Cenco" AC line-operated Titration-pH Unit has been announced recently for rapid and accurate titration, control of neutralizations, oxidation-reduction reactions, and pH measurements. Among its applications are acid and base numbers and saponification values of petroleum products, tests for dissolved oxygen in industrial wastes, electrometric measurement of pH values of aqueous or partly nonaqueous solutions, and many analyses in metallurgy. Central Scientific Co.

Check No. 7 on Reply Card

High Capacity Chemical Injector Pump Includes Provision for Multiple Feeds

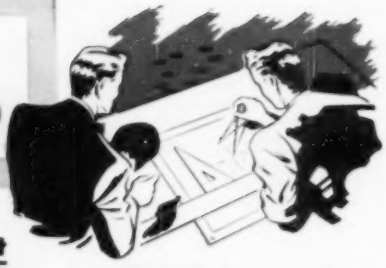


A chemical feeder capable of pumping against pressures of 300 psi. and adjustable up to one gal./min. of feed liquid has been made available. Multiple units may be obtained with any number of feeds, operated by rotary, motor, or lever drive. Pumps may be constructed of various materials to meet specific requirements in petroleum, chemical, and other industries. Operation is designed so that chemical is injected automatically in the desired proportion to the amount of liquid being pumped. Manzel Div., Frontier Industries Inc.

Check No. 8 on Reply Card

[To obtain more data on advertised products see page 424]

ASK ADSCO



to help you select the right

HEAT EXCHANGERS

Few heating or cooling problems are exactly alike. In some cases, standardized equipment can be adapted for installation, with substantial savings in cost and delivery time. On the other hand, many problems require specially designed units to meet specific operating needs.

In either case, ADSCO can provide the right equipment, expertly designed and fabricated. ADSCO offers a complete line of standard or custom-made heat exchangers in a wide variety of types.

STRAIGHT-TUBE FLOAT HEAD HEAT EXCHANGER with Removable Bundle

This ADSCO unit has extensive applications in many fields. It can be furnished as shown or with non-removable bundle. Tubes may be of copper, stainless steel or special alloys. Shells may be fabricated of carbon, stainless or nickel-clad steel or copper silicon or other alloys.

INSTANTANEOUS WATER HEATER
Water Tube Type

ADSCO instantaneous heaters include: convertors, water heaters, condensate coolers, booster heaters, oil heaters, economizers, etc. . . . gravity or forced circulation . . . vertical or horizontal . . . steam or water tube type. Usual construction is steel shell with removable copper U-tubes. Thousands of these ADSCO heaters are in use today.

STORAGE HEATER

This heater, with removable U-tube element, can be furnished in either horizontal or vertical design. Shells are fabricated, per A.S.M.E. Code, of copper silicon alloy, stainless- or nickel-clad steel, galvanized or black carbon steel. ADSCO corrosion resistant treatment adds life to black steel tanks.

ASK ADSCO for expert engineering recommendations, drawings or estimates to meet your specific problems . . . or consult your ADSCO representative. No obligation, of course.

ADSCO

EXPANSION JOINTS — HEAT EXCHANGERS
STEAM TRAPS — STRAINERS — METERS
CASING — ANCHORS — GUIDES

Leaders Since 1877

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.

Cylinder-operated Gate Valve Can Use Air, Gas, Oil, or Water for Actuation

Air, gas, oil, or water may be used to operate a new cylinder-actuated gate valve. Operation is controlled by a four-way valve, mounted on the piping leading to the cylinder. This valve admits pressure below the piston to open the valve, and by a quarter turn reverses the fluid to the chamber above the piston for closing the valve. To avoid accidental closing through fluctuations in line pressure, the upper cylinder head is equipped with a stem-holding safety device, which holds the valve open until pressure is applied above the piston. The unit can be adapted for use on any type of Kerotest gate valve. Kerotest Mfg. Co.

Check No. 9 on Reply Card

Welders' Mask for Hazardous Fumes Features Large Range of Vision

The "Pur-a-weld" full-vision gas mask has been developed to protect welders on jobs where there are hazardous gases or smokes due to product residue or vaporization. It can be used interchangeably with dust and fume canister or a compressed-air supply unit; for example, inside tanks. Maker states greater vision is available in this unit than in previous models of welding helmets. Lenses in shades from 4 to 12 can be used. Complete outfit is furnished in a compact carrying case. Acme Protection Equipment Co.

Check No. 10 on Reply Card

AMMONIA
(REFRIGERATION GRADE)

DIRECT SERVICE
FROM
PRODUCING POINT
TO USER IN

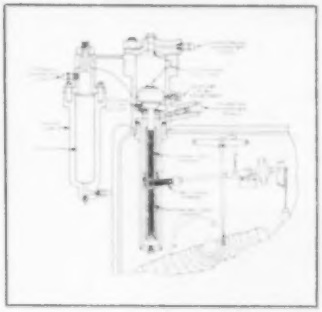
TANK CARS
and
CYLINDERS

Discuss contract
shipments or
spot orders with

SPENCER
SPENCER CHEMICAL COMPANY
Executive & Sales Offices: Dwight Bldg., Kansas City 6, Mo.

What's New!

Mercury Manometer Flowmeter Needs No Tight Bearings or Stuffing Boxes

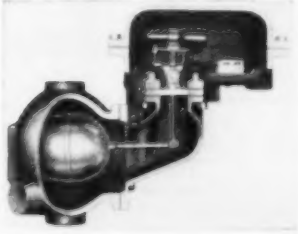


A new line of mercury manometer flow meters has been placed on the market by Fischer & Porter. No pressure-tight bearings or stuffing boxes are required, because the units use a magnetic clutch or an impedance bridge electric transmitter which is said to have three times the power of previous devices. The flow meters are available in several models: close-coupled magnetic clutch, with or without pneumatic transmission to a remote location; electric impedance bridge transmitter when it is desired to transmit to a distant exhibiting instrument; automatic control of the ratio of flow rate of two fluids; and others. Furnished with 35, 50, 100, 200 and 400 in. water column equivalent range tubes, the meters will withstand 1500 psig. in cast steel construction. Fischer & Porter Co.

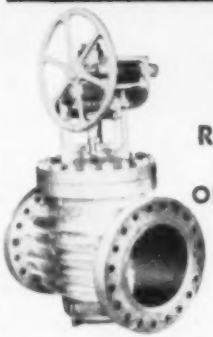
Check No. 11 *on Reply Card*

Electric Level Controller Approved for Class I, Group C and D Atmospheres

The McDonnell No. 65 is an explosion-proof, float-operated, electric level controller for water tanks, receivers, and other liquid storage systems. It has been Underwriters' tested and approved for use under Class I, Group C and Group D conditions, which includes atmospheres



WEDGEPLUG
ALL-PURPOSE
STEEL VALVES



LIFTS
TURNS
and
RE-SEATS
IN ONE
OPERATION

• DRY PLUG •

PRICED to compete with conventional plug-type valves. Interchangeable with American Standard Steel Wedge Gate Valves. Wrench-Operated; Direct Hand-wheel-Operated; Worm Gear-Operated; Sizes from 1" to 16". Write for our Catalog No. 600 and Price List. On request, we will be glad to quote on larger sizes above 16".

Wedgeplug Valve Co., Inc.
Department "P"
New Orleans 15, U.S.A.

industrial
OIL AND GAS
BURNING
EQUIPMENT

- Mechanical Atomizing Oil Burners
- Steam Atomizing Oil Burners
- Refractory Burner and Muffle Blocks
- Industrial Gas Burners
- Low Air Pressure Oil Burners
- Fuel Oil Pump Sets
- Valves, Strainers, Furnace Windows
- Tandem Block Combustion Units
- Combination Gas and Oil Burners

Detailed information gladly sent you upon request.

NATIONAL AIROIL BURNER
NATIONAL AIROIL BURNER COMPANY INC.
1297 E. Sedgley Ave., Philadelphia 34, Pa.
Southwestern Division: 2512 So. Blvd., Houston 6, Tex.

[To obtain more data on advertised products see page 424]

You're paying for this

*PRECISION-DOW DUAL RECORDOMATIC TITROMETER

until you use it-

If you run many titrations manually now, each costs you much more than with this fine new instrument.

A few weeks later, *IT PAYS YOU*

Automatically *controls* reagent-feeding and permanently *records* progress. Performs four functions at once!

With non-technical personnel, runs titrations in fraction of time required by conventional methods.

LABORATORIES REPORT: (Names on request)

1. "Paid for itself in first three months."
2. "Now run 60 titrations per day; formerly only 10."
3. "Frees our analyst for 6½ hours of other work per day."
4. "Cuts titration costs to scarcely one-third."

- Nothing like it on the market!
- Wide variety of applications!
- Surprisingly low price!
- Two complete titration set-ups!

Performing a highly complicated operation with reliable simplicity, this product is typical of those made possible by our exceptional facilities—a quarter-century of technological practice, close contact with laboratories and technical societies, complete and modern factory—all with a single responsibility.

ORDER FROM YOUR DEALER NOW . . . OR WRITE US FOR BULLETIN 3-649A

Precision Scientific Company

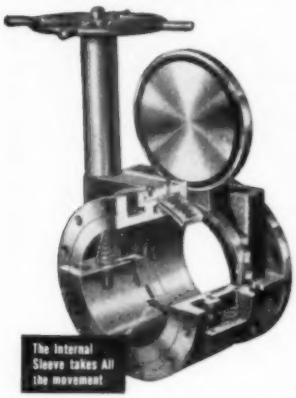
*The FINEST Research & Production Control Apparatus
3737 W. Cortland Street, Chicago 47
OFFICES IN NEW YORK • PHILADELPHIA • SAN FRANCISCO

What's New!

containing, ethyl-ether, ethylene, cyclopropane, gasoline, naphtha, butane, propane, alcohols, acetone benzol, lacquer solvents, or natural gas. It incorporates packless construction, a heavy-duty mercury switch, and totally enclosed wiring and terminals. It is furnished with a standard switch that breaks the circuit with falling liquid level, but a reverse acting switch is also available. Float chamber is heavy cast iron, float is copper, float rod is brass, and bellows bronze. Maximum body pressure is 40 psi. McDonnell & Miller, Inc.

Check No. **12** *on Reply Card*

Internal Sliding Sleeve in Blind Valve Seals and Releases Spectacle Plate



Suitable for all inflexible piping installations in petroleum refineries and other process plants, and for large diameter lines, the "Rigid" Line Blind Valve utilizes an internal sliding sleeve to seal against and release the spectacle plate without movement or expansion of the pipe line. The sleeve is moved against or away from the plate by means of a ball bearing mounted ring gear actuated by a hand wheel. Operation is not affected by misalignment or expansion and contraction of the line. Manufacturer states the spectacle plate can be reversed in less than a minute. Face-to-face dimensions are same as those of standard gate valves in all series. All parts are steel except the high tensile bronze ring gear. Spectacle plate slot is open at the top only to prevent loss of product and fire hazard. Valves are available in ASA 150 and 300 psi. classes in sizes from 6 to 12 in. Hamer Oil Tool Co.

Check No. **13** *on Reply Card*

What's New!

Plastic Insulation Coating for Vessels, Tanks Is Moisture-proof and Flexible

Vapor-tight coating has been developed which can be placed over semi-rigid insulation without first applying asbestos cement. Known as the "Insul-Mastic Vinyl System," it is an adaptation of work done by the manufacturer for the armed forces in coating B-29's and other equipment for long-term storage. A tough vinyl coating, it forms an impervious cover which is flexible and will not crack. Especially recommended for outside use; for example, on storage tanks, process vessels, piping, and the like, the material is reported to have a moisture-vapor penetration rate of 0.01 gms./100 sq. in./24 hrs., according to laboratory tests. It also has high resistance to acids and alkalis. Insul-Mastic Corp. of America.

Check No. 14 *on Reply Card*

Small Laboratory Pumps Will Handle Low Boiling Liquids or Melted Solids

Primarily developed for laboratory scale pumping of materials which are liquid at room temperature, the No. 1000 Type "C" Corson-Cerveny Micro-Bellows Pump can be adapted to handle low boiling liquids such as pentane, melted solids (naphthalene), and viscous materials. It is a pulsation type delivering a constant rate over extended periods of time. The rate is varied depending on the size of the bellows and position of an adjusting nut. Pump uses no packing gland or stuffing box, and has a stainless steel bellows electric welded to stainless steel fittings and attached to a stainless steel check assembly. All connections are machined fits. Two models furnish 15-1000 ml./hr. or 30-2000 ml./hr. flow rates. Overall dimensions are 6 x 3½ x 10⅜ in.; weight is 5.6 lbs. Pipe connections are ⅛-in. Drive motor is 110 volt, 60 cycle, 30 rpm. Research Appliance Co.

Check No. 15 *on Reply Card*

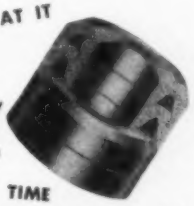
Volumetric Flow Meter Is Designed For Handling Corrosive Materials

The "Veriflow" Meter and "Veritrol" for indicating and controlling the rate of flow of corrosive liquids operates on the volumetric priciple, requiring no weigh tanks, orifice plates, or gage sticks. Types of fluids which can be handled include acetic acid, concentrated sulfuric acid, ammonia, phosphoric acid, po-

EVERY WAY YOU LOOK AT IT

PALMETTO *Pyramid*®

LOWERS YOUR DOWN TIME



Total up the man-hours lost in frequent repacking —or in equipment failure due to faulty packing . . . you'll discover the economy of selecting Palmetto first. The Pyramid is typical.

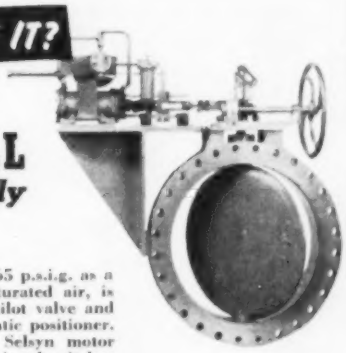
- Not one, but many styles — fabric and binder varied to match your service condition. That means dependable, tailored performance.
- Uniform, heavier wall construction. Each ring sits squat and true . . . will not split at the hinge . . . no raw edges to fray. That means longer life, sturdier performance all the way.

Write for all the facts. Bulletin MP-20 yours for the asking.

GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA

WHERE CAN YOU USE IT?

This ROCKWELL
Automatic Butterfly
VALVE



This 30" cast steel valve, built for 65 p.s.i.g. as a suction valve to ejectors handling saturated air, is equipped with a hydraulic cylinder, pilot valve and connecting arms actuated by a pneumatic positioner. Valve slide position is indicated by Selsyn motor units operated by remote control, with signal switches to indicate full open and full closed position. A declutchable handwheel for emergency manual operation is also provided. This is but one of many types of Rockwell automatic valves available up to 84" pipe size.

Whether for controlling air or gases at high or low temperatures or pressures, process fluids or granular solids, there's a Rockwell slide or butterfly valve of any metal, any size, with any desired control mechanism to meet your specific needs. Get our catalog.

ROCKWELL VALVES FOR AIR · GAS · LIQUIDS · SOLIDS

W. S. ROCKWELL COMPANY, 250 Eliot St., Fairfield, Conn.

[*To obtain more data on advertised products see page* 424]

FRESH OUT OF AIR, SIR?

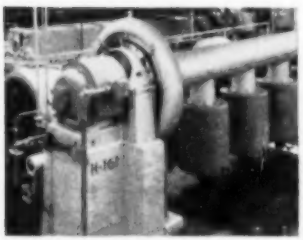
Call on *R-C dual-ability* to move air or gas in any quantities for industrial uses

When you have a job of handling gas or air, in quantities from 5 cfm to 100,000 cfm, Roots-Connersville will do it efficiently and economically. With many sizes and types, we can match blowers, exhausters and gas pumps closely to the job, to reduce first cost and operating costs.

R-C *dual-ability* offers you the exclusive, *dual* choice between Centrifugal and Rotary Positive designs. You can select single-stage or multi-stage units, from our standard lines, with flexibility as to drives and other accessories to meet your needs.

To aid in your specifications, our air-and-gas specialists are at your service. With nearly a century of experience behind them, they can help you solve almost any problem of handling air or gas.

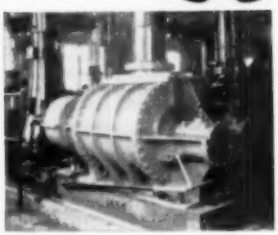
ROOTS-CONNERSVILLE BLOWER CORPORATION
504 Texas Avenue, Connersville, Indiana



Type OI Centrifugal Blower in oil refinery operation. Capacity 11,750 cfm.

Rotary Positive Gas Pump for handling refinery gas. Capacity 3,100 cfm.

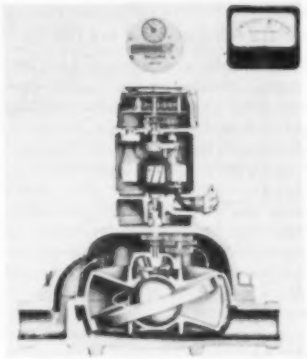
ROTARY



ROOTS-CONNERSVILLE

ONE OF THE DRESSER INDUSTRIES

What's New!



tassium hydroxide, etc. Operation is similar to a volumetric gasoline meter. Circular motion of the piston is transmitted to a generator, with the flow indicator measuring the output of the generator. The Hays Corp.

Check No. **16** *on Reply Card*

Trade Literature

Houdriflow Catalytic Cracking

Houdry Pioneer, Vol. 5, No. 1, February, 1950, consists of an illustrated article; "Development of Houdriflow Catalytic Cracking," by R. E. Bland, A. W. Hoge, and G. F. Hornaday. Houdry Process Corp.

Check No. **17** *on Reply Card*

Chlorine and Caustics

The Mathieson Mercury Cell Process for the Manufacture of Chlorine, Caustic Soda, and Caustic Potash, Bulletin No. 2261; a 28-page booklet giving complete description of a new process. Serving as engineer-contractor for the design and erection of plants embodying the new technique is the Chemical Plants Division of Blaw-Knox Co.

Check No. **18** *on Reply Card*

Valve-sizing Charts

Gas Valve Sizing Chart and *Liquid Valve Sizing Chart*, Supplement Two, Catalog 70; a single-page folder covering the ranges 0.02 to 10,000 gpm. and 1 to 100,000 lbs./hr.; the liquid valve chart takes into account the difference between pressure drop across the valve and across valve ports alone, viscosity, and specific gravity in determining port area and valve size; the gas valve chart takes into account inlet and outlet absolute pressures, gas specific gravity, and temperature. Fischer & Porter Co.

Check No. **19** *on Reply Card*

Three Paths

TO PROFITABLE PERFORMANCE

with Wolverine Condenser Tubes

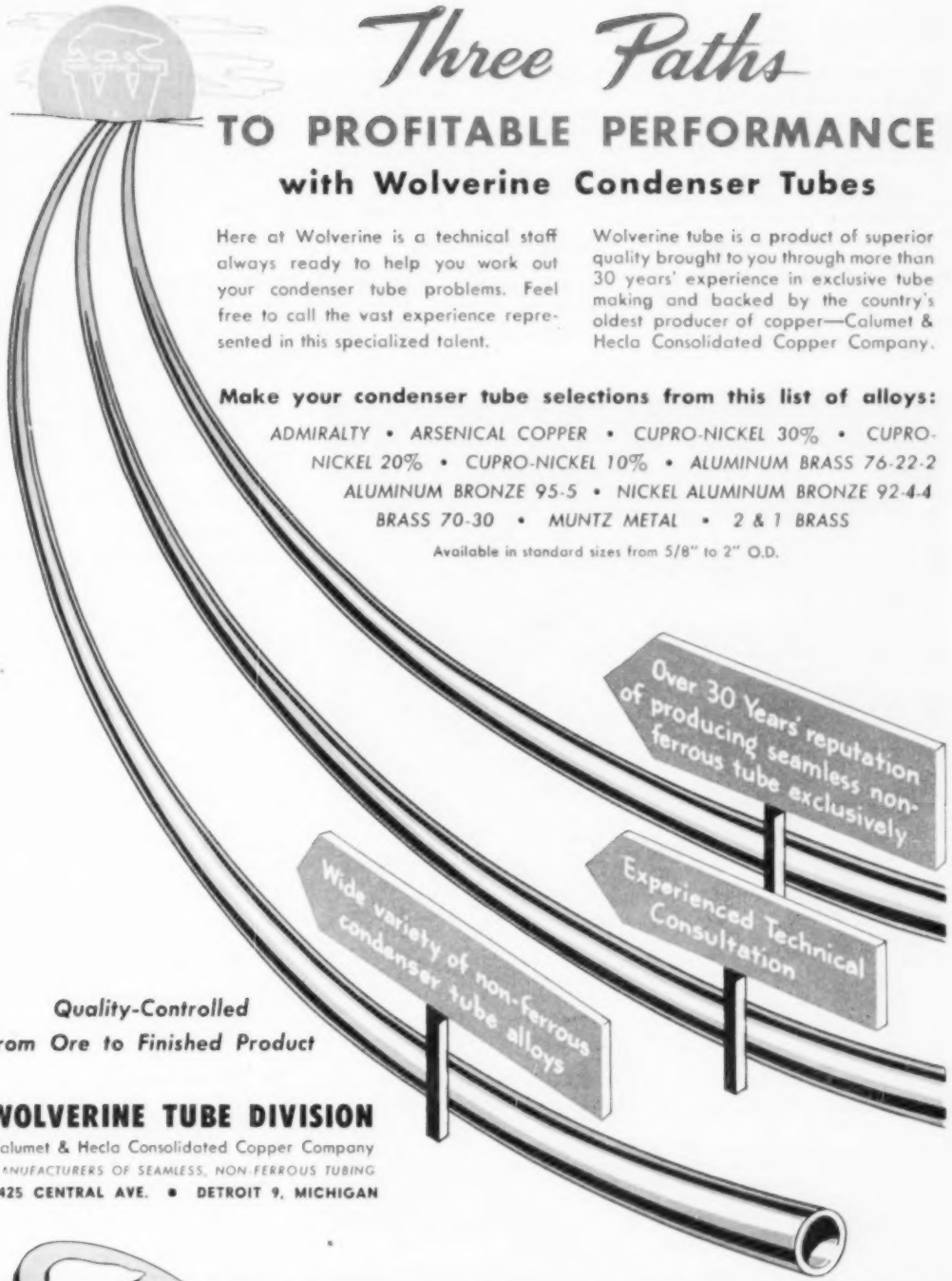
Here at Wolverine is a technical staff always ready to help you work out your condenser tube problems. Feel free to call the vast experience represented in this specialized talent.

Wolverine tube is a product of superior quality brought to you through more than 30 years' experience in exclusive tube making and backed by the country's oldest producer of copper—Calumet & Hecla Consolidated Copper Company.

Make your condenser tube selections from this list of alloys:

ADMIRALTY • ARSENICAL COPPER • CUPRO-NICKEL 30% • CUPRO-NICKEL 20% • CUPRO-NICKEL 10% • ALUMINUM BRASS 76-22-2 ALUMINUM BRONZE 95-5 • NICKEL ALUMINUM BRONZE 92-4-4 BRASS 70-30 • MUNTZ METAL • 2 & 1 BRASS

Available in standard sizes from 5/8" to 2" O.D.


Over 30 Years' reputation of producing seamless non-ferrous tube exclusively
Experienced Technical Consultation
Wide variety of non-Ferrous condenser tube alloys

Quality-Controlled from Ore to Finished Product

WOLVERINE TUBE DIVISION

Calumet & Hecla Consolidated Copper Company

MANUFACTURERS OF SEAMLESS, NON-FERROUS TUBING

1425 CENTRAL AVE. • DETROIT 9, MICHIGAN

PLANTS IN DETROIT AND DECATUR, ALA.

Sales Offices in Principal Cities

Floating Tank Roofs

Horton Floating Roofs, Bulletin B: a new 20-page booklet describing floating roofs, including double-deck, pontoon, and pan types, types of service to which they are put, accessories used, operation and maintenance. Chicago Bridge & Iron Co.

Check No. **20** *on Reply Card*

How to Use Aluminum Paint

Painting with Aluminum; a 32-page brochure explaining the uses of aluminum paint on metal, concrete, masonry, wood, and the like, how it should be applied; and including a series of helpful questions and answers about industrial maintenance painting and a coverage table. Aluminum Co. of America.

Check No. **21** *on Reply Card*

Corrosion Resistant Alloys

Hastelloy High-Strength, Nickel-Base, Corrosion-Resistant Alloys; new 7th Edition; 40 pages covering the four Hastelloy alloys, with tables showing resistance to six common corrosive media, properties at room, elevated, and sub-zero temperatures, and compared to four other common construction materials; including proper procedures for welding, working machining, etc. Haynes Stellite Division, Union Carbide and Carbon Corp.

Check No. **22** *on Reply Card*

Valve Actuators

Pneumatic Operators, Technical Bulletin 104; eight pages covering the design, operation, and application of air motor, diaphragm motor, and piston operated valve positioners for throttling control service; including a new operator that employs a gear driven screw stem positioned by a reversible pneumatic motor. Conoflow Corp.

Check No. **23** *on Reply Card*

Glass Fractionator Prices

Glenlab Fractionating Distillation Equipment Price List, Form No. 4G250FE4; includes perforated columns in ⅝, 1, 2, 3, and 4 in. diameters; packing type columns in ¾, 1, and 1½ in. diameters; and an automatic vapor-dividing column unit for semi-micro operations; indicating price reductions of about 10% from previous listings. Glass Engrg. Laboratories.

Check No. **24** *on Reply Card*

Meter Calibrating Tanks

Excel-So Meter Calibrating Tanks, Bulletin No. CT 101-50; describes line of this equipment designed for refineries, terminals, pipe lines, tank trucks, loading racks, and state sealers, in sizes ranging from 50 to 2000 gals., and 2 to 30 bbls., stationary or portable, with or without springs, open or closed type necks, and with electric or pneumatic brakes. Warner Lewis Co.

Check No. **25** *on Reply Card*

Glass Blowing Equipment

Glass Blowing Equipment, Catalog 50: 48 pages covering cutting tools, holders, burners, shapers, pumps, and tubing, joints, stopcocks, etc.; including prices. Scientific Glass Apparatus Co., Inc.

Check No. **26** *on Reply Card*

Wired Television

Diamond Utiliscope, Bulletin 1025; a 16-page booklet describing a form of wired television system designed for use in industry, research, etc., as a means of visible communication. Diamond Power Specialty Corp.

Check No. **27** *on Reply Card*

★ SIMPLIFIED RING CUTTING — Super Seal can easily be pulled down to any shaft or stem size.

★ POSITIVE PACKING IDENTIFICATION — Super Seal styles are clearly marked, each one in a different color.

For many years, SUPER SEAL No. 3 has been achieving outstanding service records in valves and centrifugal pumps handling oils, solvents and petroleum distillates on refinery applications. It is highly recommended for temperatures to 550° F.

Now, with patented "tape-back" construction, SUPER SEAL is easier to use, easier to identify. It's another special "John Crane" feature to insure perfect packing satisfaction.

It's hard to believe the resilience of "tape-back" SUPER SEAL until you twist it down yourself. Send for a sample and try it.

JOHN CRANE
CRANE PACKING COMPANY
1832 CUYLER AVENUE · CHICAGO 13, ILLINOIS
Offices in All Principal Cities in United States and Canada

Dry Plug Valves

Wedgeplug Valves, Catalog No. 600; describes a line of several models of quick acting dry plug valves, wrench, hand-wheel, and worm-gear operated, with Venturi, rectangular port, and full round port openings, in sizes from 2 to 16 in., and W. O. G. ratings to 1000 psi., carbon steel construction. Wedgeplug Valve Co., Inc.

Check No. **28** *on Reply Card*

Water Treatment

Hot Process Water Softeners, Bulletin WC 102; 36 pages with flow charts, installation photographs, and diagrams, outlining 12 methods for treating boiler water, explains the chemistry of hot process water softening, and describes two basic designs of this type of equipment. Graver Water Conditioning Co.

Check No. **29** *on Reply Card*

Meters Flow Rates to 6200 gpm.

Ratosleeve Flow Meters, Catalog 83: describes three basic units in standard pipe tees plus indicators, controllers, recorders, or telemetering instruments for variable-area type flow metering for rates from 2 to 6200 gpm. and from 3 to 12,500 cfm. Fischer & Porter Co.

Check No. **30** *on Reply Card*

Heat Exchangers & Water Heaters

Patterson Instantaneous Hot Water Heaters and Heat Exchangers, Catalog No. 202: 36-page booklet describing line of products for steam pressures from 0 to 100 lbs., including typical piping arrangements, pressure loss tables, and selection charts for 2, 4, and 6-pass heaters. Patterson-Kelley Co., Inc.

Check No. **31** *on Reply Card*

Pneumatic Transmitter

F-C Pneumatic Transmitter, a four-page folder explaining operation of a transmitter using the principle of force balance air flow, and in which the air is isolated from the fluid being measured; can be used for liquid level, pressure differential in a catalyst bed, flow rate of Bunker "C" oil, specific gravity of molten chlorides, and many other applications. Instruments, Inc.

Check No. **32** *on Reply Card*

Non-destructive Metal Inspection

Ultrasonic Reflectoscope, Bulletin 50-105; gives operation, specifications, and other useful information on the Type UR instrument for non-destructive testing of metals for defects. Sperry Products, Inc.

Check No. **33** *on Reply Card*

Combustibles Recorder Uses Catalysis

Baily Combustibles Recorder, Bulletin 150-A: 16 pages on operation and application of this electronic-type instrument, which operates on catalytic combustion principle. Baily Meter Co.

Check No. **34** *on Reply Card*

For Your Convenience

Business reply cards are included in this issue of PETROLEUM PROCESSING to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing page 425. Just check the numbers corresponding to the numbers on the items you're interested in, fill in the bottom of the card, and drop it in the mail. No postage required.

Controlled Odorization

IN NATURAL GAS DISTRIBUTION

with the New Consolidated

TITRILOG

CONSOLIDATED TITRILOG
Model 26-102

Accurate control of the odorization of natural gas is a major problem facing many gas distribution companies today. The importance of odorizing gas to a known and fixed level, in order to assure its safe and economical distribution, is ever increasing with the rapid expansion of natural gas utilization.

The Consolidated Titrilog is now being used in production plants and on distribution lines to continuously record the concentration of the odorant in the stream. Thus, a constant odor level in the gas is insured and a permanent record is acquired for legal evidence of effective odorization.

The Titrilog quantitatively records sulfur compounds such as H_2S, SO_2, mercaptans, thioethers, thiophene, and organic disulfides in concentrations as low as 0.1 ppm or 0.005 grains per 100 cubic feet. Compounds of specific interest may be separately determined over a wide range of concentrations.

For complete information on the Consolidated Titrilog and other applications, such as problems in corrosion, sour-gas treating, etc., write for Bulletin CEC-1810-X8.

SPECIFICATIONS

Sensitivity The Titrilog quantitatively records oxidizable sulfur compounds in concentrations as low as one part in ten million or 0.005 grains per 100 cubic feet.

Power Requirements The Titrilog operates on standard 60-cycle 115-volt power. It requires approximately 6 amperes.

Cabinet Dimensions The Model 26-102 Titrilog is housed in a floor-mounted cabinet 66-inches high, 22½-inches wide, and 18½-inches deep. The strip-chart recording milliammeter is mounted at eye level, and directly below it is the control panel.

CEC

CONSOLIDATED ENGINEERING CORPORATION

Analytical Instruments for Science and Industry

620 NO. LAKE AVE. PASADENA 4, CALIFORNIA

[*To obtain more data on advertised products see page* 424]

Personals

Vice Admiral Earle W. Mills, U. S. Navy (Retired), has been elected president of Foster Wheeler Corp., and **David McCulloch,** formerly vice chairman of the board, has been elected chairman of the board. **Harry Sanford Brown,** formerly chairman of the board and president, died suddenly on Feb. 18.

Vice Adm. Mills

Mr. McCulloch

Wartime Deputy Chief of the Bureau of Ships, and Chief of that Bureau in 1946, Admiral Mills joined Foster Wheeler in 1949 as executive vice president and a director.

Mr. McCulloch joined the Power Specialty Co., a predecessor of Foster Wheeler Corp., in 1906. In 1927, when the present corporation was formed, he was made secretary. He assumed the duties of executive vice president in 1935, a position which he held until 1949, when he was made vice chairman of the board.

* * *

W. Anthony Newhoff, vice president of Union Oil Co., has been elected a director of Central Valley Bank of California. Mr. Newhoff's business interests center largely in the areas served by the bank, since he has supervision of 131 Union oil plants, many of which are located in Contra Costa, San Joaquin and Alameda Counties, including one of the company's major refineries, at Oleum. He has been with Union for 30 years, starting as a service station operator and advancing through various positions to vice president.

* * *

Harry A. Jarvis, manager of the refinery department of Creole Petroleum Corp. in Venezuela, has been appointed a member of the company's Management Committee.

Mr. Jarvis has had nearly 20 years experience in the oil business, most of it in South America. After graduation from the University of Maryland in 1930, he was employed at the Bayway, N. J., refinery of Standard Oil Co. He left for Argentina in 1931 to accept the position of junior engineer with the Campana refinery of Campania Nativa de Petroleo, and ultimately rose to the position of president and general manager of this company. He joined Creole in Venezuela in 1947 as assistant manager of the refinery department and was manager of the company's Amuay Bay refinery project in 1948.

* * *

Fred C. Koch, president of Wood River Oil & Refining Co., Witchita, Kans., and **D. W. Hovey,** president of Danaho Refining Co., Houston, Texas, have been made chairmen of two special study committees for the Independent Refiners Assn.

Mr. Koch was appointed chairman of the Petroleum Tax Committee which will study taxes at all levels ranging from the exploratory efforts directed toward the finding of new reserves to the consumption of finished products by the public. Mr. Koch was the IRAA representative at the recent depletion hearing conducted by the House Ways and Means Committee.

Mr. Hovey will head the Petroleum Economics Committee to study all phases of economics affecting the independent refiner. Included in this study will be an analysis of the impact of decycling operation as affecting the independent refiner and industry as a whole.

* * *

Norval F. Myers, formerly asst. chief engineer in the Esso Engineering Dept. of Standard Oil Development Co., has been elected a director of Anglo-American Oil Co., Ltd., and will head up its refining activities in the United Kingdom.

Paul J. Harrington has been named to replace Mr. Myers.

A graduate of Beloit College, Princeton University and Massachusetts Institute of Technology, Mr. Myers joined the Development Co. as assistant chief engineer in 1941. Previously he had served for 16 years in the oil industry in research chemical engineering and in various manufacturing management capacities. He was awarded the Medal of Merit by President Truman in 1948 for his work during World War II with National Defense Research Committee.

* * *

T. G. Stevenin, recently chemical engineer of the U. S. Government's Northern Regional Research Laboratory at Peoria, Ill., was named plant technologist at Deep Rock Oil Corp.'s Cushing, Okla., refinery and **J. W. Beam,** formerly instrument engineer with Universal Oil Products Co. was

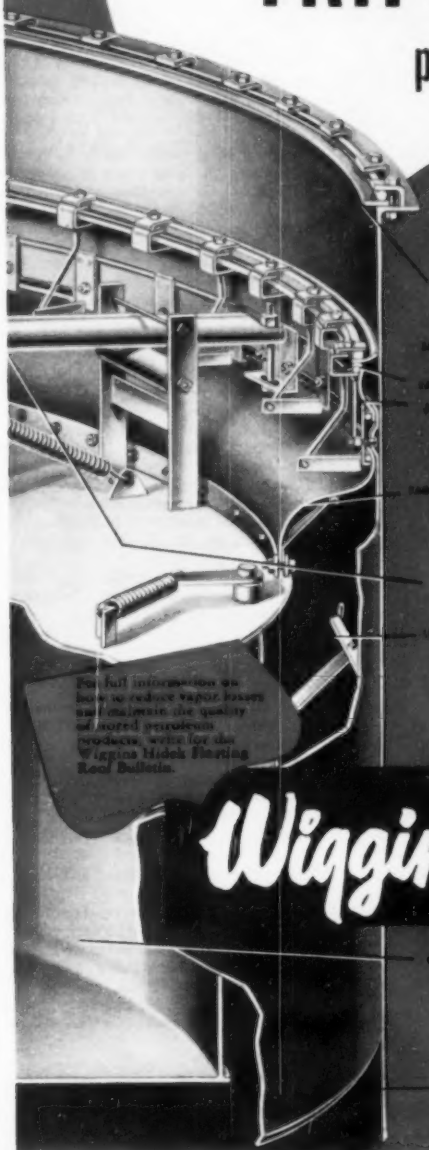
Guns have been a hobby with **Walter M. Price,** research chemist, Cities Service Oil Co. technical laboratory, East Chicago, Ind., since he was eight years old. In the intervening years he has collected well over a thousand different guns.

At the present time, his interest centers on Colt frontier 6-shooters. Four are displayed on the wall to the left of the picture and the fifth, his father's old .44 Remington which he had converted to .22 caliber, he holds in his hand. His extensive collection includes all types from poor-grade foreign military issue arms to fine trap, skeet, and three barrel combination rifles and shotguns.

No other floating roof gives you . . .

TRIPLE SEAL

protection



TOP SEAL

Enables use of full tank capacity without increasing shell height. Cuts out 75% of evaporation losses and fire hazard when tank is full.

SECONDARY SEAL

Stops wind from sucking valuable vapors out of slot. Saves 50% of the evaporation losses suffered by tanks with a single seal. Standard equipment with Wiggins Floating Roofs for extra savings.

PRIMARY SEAL

Has the much-copied long limber shoe originated by John H. Wiggins to assure positive, constant contact with the tank shell. A unique hanger maintains continuous contact regardless of any irregularities. Equally effective on riveted or welded tanks.

For full information on how to reduce vapor losses and maintain the quality of stored petroleum products, write for the Wiggins Hinged Floating Roof Bulletin.

The improved and never surpassed

Wiggins Floating Roofs

GENERAL AMERICAN

TRANSPORTATION CORPORATION

135 South LaSalle Street, Chicago 90, Illinois

District Offices: Buffalo • Cleveland • Dallas • Houston • Los Angeles • New Orleans • New York • Pittsburgh • St. Louis • San Francisco • Seattle • Tulsa • Washington • Export Dept., 10 East 49th Street, New York 17, New York

AUTO-LITE

TEMPERATURE INDICATORS

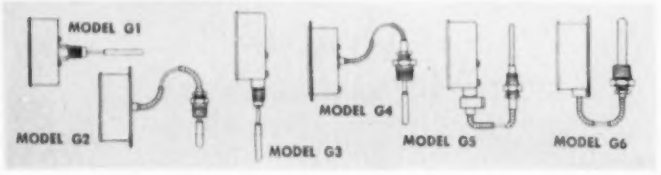
For your specific needs!

- ★ Precision-built indicators provide accurate temperature readings.
- ★ Low-cost protection . . . due to large, specialized production.
- ★ Wide selection of dial ranges to meet specific requirements.
- ★ 6 stock types available as shown.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION Dept. P-4
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

MODEL "G"

Select the type that is best for your purpose. 3½" dial; evenly calibrated scales. From $18 up.



NEW!

STAINLESS STEEL BODY

makes a good steam trap better . . . at no increase in cost to you. Means reduced maintenance for the trap that gets equipment hotter, sooner and keeps it hot! Over 600,000 Yarways already installed! Sold by distributors throughout the world.

YARNALL-WARING CO. 153 Mermaid Ave., Phila. 18, Pa.

appointed supervisor of the instrument department.

Stevenin obtained his first B.S. degree in chemical engineering from the University of Kansas in 1939, and another in general agriculture from the University of Illinois in 1948. Following earlier experience in Standard Oil Co. of Indiana's Whiting refinery, he served as process engineer for Phillips Petroleum Co. at Bartlesville, Okla.

Beam attended schools in his home state of Georgia, including Georgia Tech, before receiving his B.S. degree in engineering from Purdue University in 1944. In 1945 he joined Universal Oil Products and became the company's chief field instrument engineer before joining Deep Rock.

* * *

Dr. O. E. Bransky has been named chief of the petroleum branch of Economic Co-operation Administration. He has been acting director since last September, when former director **Walter Levy** resigned.

Prior to joining ECA in 1948, Mr. Bransky was associated with Indiana Standard. At one time he served as manager of the company's Whiting, Ind., refinery, and was assistant general manager of its manufacturing department when he retired in 1948.

* * *

Carl S. Reed, president of the Lummus Co. since its formation in 1930, has been elected chairman of the board of directors. **James F. Thornton,** with the company for 14 years, has been promoted from executive vice president to fill the vacancy left by Mr. Reed's election.

* * *

Sylvester Dayson, president of Premier Oil Refining Co. of Texas and general manager of Premier Petroleum Co., resigned Mar. 1, but will continue to serve the companies on a consulting basis. **R. P. Hargis,** associated with Mr. Dayson for more than 25 years, is the new president and general manager of the companies.

* * *

Ralph Booker, former vice president and assistant general manager of Rock Island Refining Corp., has been made general manager of all operations of National Cooperative Refinery Assn., McPherson, Kans.

* * *

L. F. Knox, General Petroleum Corp.'s chief safety engineer, retired in January after 23 years with the company. Mr. Knox has been engaged in safety work since 1930, and has been active in safety committees of API and Western Oil & Gas Assn.

* * *

Andrew E. Chute has joined the Arthur G. McKee & Co. as asst. technical director. He was formerly a senior process engineer with Foster Wheeler Corp.

OBITUARIES

George Nelson Moore, 71, former president of Shaffer Oil & Refining Co. (now Deep Rock Oil Corp.), died in Decatur, Ill., Feb. 11. Mr. Moore organized the Moore Refining Co., Arkansas City, Kans., in 1922, served as president of Western Petroleum Refiner's Association during 1921 to 1924, and was formerly manager of Cosden & Co.'s refining division.

* * *

Edwin Franklin Williams, 74, retired Gulf Refining Co. employe, Pt. Arthur, Texas, died Feb. 17 at Beaumont.

* * *

James C. McLaughlin, 81, retired employe of Quaker State Refinery Co., died in Franklin, Pa., on Feb. 8. Mr. McLaughlin had been associated with Emlenton Oil Refinery Co. and with Quaker State for 43 years until his retirement.

* * *

August H. Pederson, foreman at Tide Water Associated Oil Co.'s Bayonne, N. J., refinery, died Jan. 30.

* * *

Paul Coulston, foreman at the Bayonne, N. J., refinery of Standard Oil Co., died Jan. 31. Mr. Coulston was a company employe for 35 years.

Edgar Poe Thomason, 82, employe of Gulf Oil Corp., died Feb. 3. Mr. Thomason had been with the company's Port Arthur, Texas, refinery for 22 years.

* * *

Carl H. Alsberg, 65, manager of the Franklin refinery of L. Sonneborn Sons, Inc., died Feb. 9 in Franklin, Pa. Mr. Alsberg joined Sonneborn Sons in 1911 and was manager of the Daugherty oil refinery at Petrolia, Pa. from 1923 to 1925.

MEETINGS
. . . for the Oil Man

APRIL

12-14, National Petroleum Assn., Semi-Annual Meeting, Hotel Cleveland, Cleveland.

16-20, American Chemical Society, 117th National Meeting (divided), Detroit.

17-19, Society of Automotive Engineers, Aeronautic and Aircraft Engineering Display, Statler Hotel, New York.

24-25, Industrial Accident Prevention Assn., Royal York Hotel, Toronto, Canada.

24-26, Natural Gasoline Assn. of America, 29th Annual Convention, Texas Hotel, Fort Worth.

24-26 American Society of Mechanical Engineers, Process Industries, William Penn Hotel, Pittsburgh.

24-27, American Management Assn., 19th National Packaging Exposition, Navy Pier, Chicago.

MAY

1-4, American Petroleum Institute, Refining Division, Annual Spring Meeting, Hotel Cleveland, Cleveland.

7-9, Independent Petroleum Assn. of America, mid-year meeting, Los Angeles, Calif.

8-11, Liquefied Petroleum Gas Assn., Annual Convention and Trade Show, Palmer House, Chicago.

10-14, Houston Industrial Exposition, 1st Annual Meeting, Coliseum, Houston.

15-18, National Fire Protection Assn., Annual Meeting, Haddon Hall, Atlantic City.

15-18, American Petroleum Institute, Central Committees on Accident Prevention and Fire Protection, Mid-Year Meeting, Haddon Hall, Atlantic City.

22-24 American Gas Assn., Production and Chemical Conference, Hotel New Yorker, New York.

28-31, American Institute of Chemical Engineers, Regional Meeting, New Ocean House, Swampscott, Mass.

JUNE

4-9, Society of Automotive Engineers, Summer Meeting, French Lick Springs Hotel, French Lick, Ind.

8-9, American Management Assn., Hotel Statler, New York.

12-16, American Society of Mechanical Engineers, Oil and Gas Power Division Conference and Exhibit, Lord Baltimore Hotel, Baltimore.

12-16, American Institute of Electrical Engineers, Summer and Pacific General Meeting, Huntington Hotel, Pasadena.

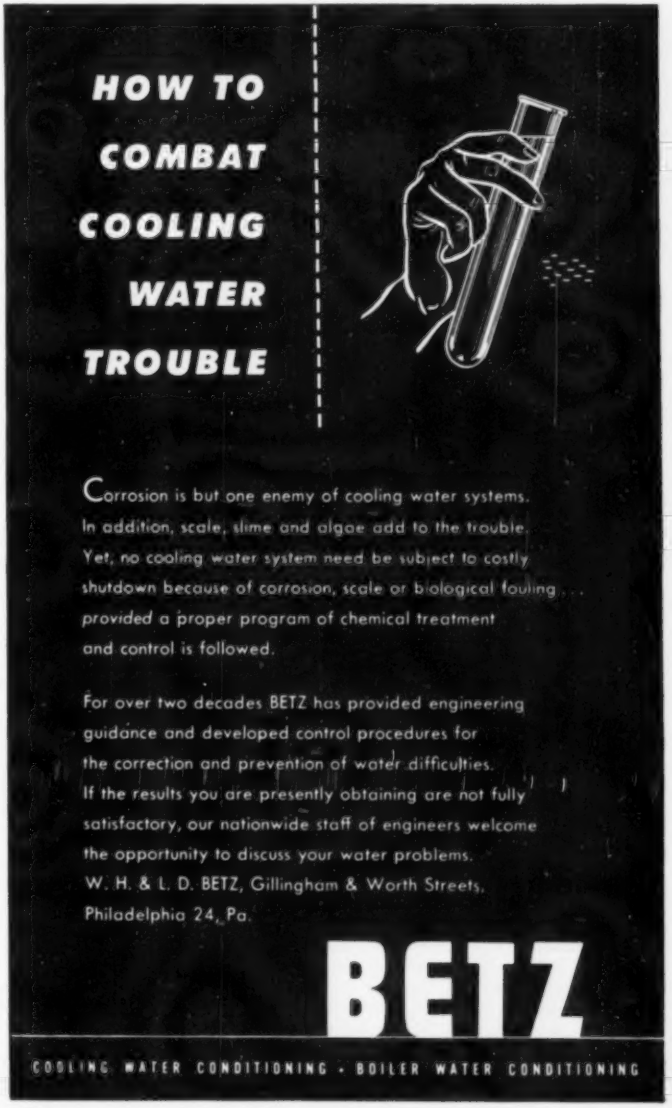
15-16, Pennsylvania Grade Crude Oil Assn., Annual Meeting, Hotel William Penn, Pittsburgh.

19-23, American Society of Mechanical Engineers, Semi-Annual Meeting, Hotel Statler, St. Louis.

26-30, American Society for Testing Materials, 53rd Annual Meeting, 9th Exhibit of Testing Apparatus and Related Equipment, Chalfonte-Haddon Hall, Atlantic City.

JULY

3-7, The Institute of Petroleum, Second Oil Shale and Cannel Conference, Glasgow, Scotland.


HOW TO COMBAT COOLING WATER TROUBLE
Corrosion is but one enemy of cooling water systems. In addition, scale, slime and algae add to the trouble. Yet, no cooling water system need be subject to costly shutdown because of corrosion, scale or biological fouling . . . provided a proper program of chemical treatment and control is followed.
For over two decades BETZ has provided engineering guidance and developed control procedures for the correction and prevention of water difficulties. If the results you are presently obtaining are not fully satisfactory, our nationwide staff of engineers welcome the opportunity to discuss your water problems.
W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa.
BETZ
COOLING WATER CONDITIONING • BOILER WATER CONDITIONING

[To obtain more data on advertised products see page 424]

EDITORIAL VIEWPOINTS...

Opinions and Comments on Current Topics

Industry Should Make Certain That Public Gets Straight Story on Federal Synthetics Program

ONE duty that the oil industry certainly owes both itself and the public—and which at last at least one oil man has undertaken to discharge—is to present all the facts, as far as they can be had, of just what it is that the government is doing and is actually accomplishing in government laboratories and pilot installations in synthetizing liquid fuels from coal and shale.

The industry should get and give to the public all the facts, if possible, not only concerning the technical developments the government may be accomplishing with its "experiments" but also what the government is trying to do with expenditures of $35,000,000 or the contemplated one of $65,000,000 or more on alleged "pilot" plants. Are these expenditures planned on such a large "pilot" plant basis so as to be actually putting the government into the business of making fuel from shale and coal in competition with the oil industry?

The industry should also tell just what it has accomplished by its private research privately financed to the tune of many millions, and just what of this research the government is using and will use in its research program.

We believe it is a fair statement from all the facts and speeches and press agent handouts we have seen in recent years, that not once has the government given the industry, or any one else for that matter, any credit for the work it has done so far. In fact, these press stories that keep coming out of Washington in rather a steady flood seem to indicate that no one thought of getting motor fuel out of coal or shale until the Bureau of Mines concocted the idea a few years ago. Government officials do not say one word about all the millions of dollars and years of hard work oil companies have spent directly on this research, to say nothing of the many other millions spent on the basic research of refining processes that make it possible to manufacture a usable fuel from these shale and coal liquids.

The oil man who has just spoken out forcefully on behalf of what the oil industry has done in developing fuels from coal and shale is A. L. Solliday, executive vice president of the Stanolind Oil & Gas Co. (Standard of Indiana production and natural gasoline subsidiary). Mr. Solliday not long since presented some facts on the industry's side of this story to the fall meeting of the Petroleum Branch of the American Institute of Mining and Metallurgical Engineers at San Antonio on Oct. 6.

When the Bureau of Mines the other week issued its reports on synthetic fuels, Mr. Solliday made a personal statement taking blunt issue with many of the bureau's statements, some of which he calls false and others misleading. The nub of Mr. Solliday's contention is that the government is nowhere near producing the liquid fuels from these materials and at the cost it says or as it would have the public believe.

The oil industry, through its many technical men who have done far more work on this subject than the government people should support Mr. Solliday with similar statements.

It undoubtedly would be well for the API to charge a committee—probably its committee on oil refining—to name a subcommittee whose duty it will be to check closely all statements emanating from the government and when such statements are not in accord with the facts, or do not give the industry credit for what the industry has done toward the same end, to frankly say so. That oil committee should also set up an accounting committee to inspect and carefully audit all cost figures that the government may have. The government should be willing to let such a committee have full access to all its data and books. If the government does not do so then the government's failure to accept complete check of its statements will at once raise the question of how fair and how accurate are its figures? If the government refuses to thus co-operate with the industry's representative, the refusal of the government can be submitted to various committees and subcommittees on appropriation of Congress to whom the government must go for funds to carry on this work. The industry might also present the need for such auditing to one of the investigating committees now studying government activities.

But whatever the method pursued, the industry should insist upon making such a continuous check-up and audit of accounts on this "research" and make public what it finds. The taxpayers are paying the money—not the bureaucrats—so the taxpayers should be kept informed. There is also a direct responsibility on the oil industry, to whom the taxpayers naturally look to keep tab on this expenditure, to get the facts and inform them—the taxpayers.

What competent oil experts may find, if given full access to the government's data and books, should also throw much light on just what the government is trying to do. Is it trying to further the science of hydrocarbon technology and to assist the industry in developing low cost methods of getting motor fuel from shale and coal, or is the government, by these large appropriations and requests for future appropriations, trying to establish a new industry to be not only owned but run by the government?

If it is only a research job, then just how far has the government gone and is that distance worth the cost and has industry paralleled it or perhaps gone beyond it?

A collateral question also is—is it the function of government thus to duplicate and invade the field of taxpaying private enterprise?

If this "research work" is to launch government in the synthetics fuel industry then the sooner that fact is brought out in the open for general discussion by Congress, the industry and the public, the better. There has been too much creeping into the fields of private enterprise by our government the past 18 years for the taxpayer not to view at least with great interest every activity that may indicate another such attempt.

In the meantime, the industry owes Mr. Solliday and his supporting associates in the Standard of Indiana organization, a vote of thanks for speaking out so forthrightly on behalf of a still free and privately owned and operated oil industry.

—W.C.P.

How Do These GENERAL CHEMICAL FLUORIDES Fit Into Your Operation?

SODIUM BIFLUORIDE

SODIUM FLUORIDE

RIMMED STEEL: Added in pouring billets to insure a smooth rolled sheet.

LAUNDRIES: As a "sour" to neutralize excesses of soap and other alkaline detergents; to remove iron stains.

WATER TREATMENT: For fluoridation of public water supplies.

GLASS: As an etching and frosting agent.

PEST CONTROL: For extermination of vermin.

LEATHER: For treating infected hides.

ADHESIVES & STARCHES: In manufacture of glues and liquid starches.

MAINTENANCE: In cleaning stone and brick building exteriors.

HEAT TREATING: Ingredient of salts.

STAINLESS STEEL: As a Hydrofluoric Acid substitute in pickling baths.

WOOD PRESERVATIVE: To prevent insect attack on structural and other materials.

BASIC CHEMICALS

FOR AMERICAN INDUSTRY

THE WIDE VERSATILITY of General Chemical Sodium Fluorides enables them to play important and varied roles: from the manufacture of rimmed steel, to the treatment of public water supplies . . . from pest extermination, to commercial laundry work. Their chemical and physical properties indicate they may offer advantages worth investigating for many other operations too.

FOR DETAILED information on the quality and characteristics of these products, or for expert Technical Service in determining their potentialities for *your* operations . . . contact the nearest General Chemical office listed below.

General Chemical Sodium Fluoride and Sodium Bifluoride are available in the following strengths and densities: Sodium Fluoride, white—light or dense, 90% and 95% NaF, also Nile Blue—light, 95% NaF; Sodium Bifluoride, powdered, 90% $NaHF_2$.

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Offices: Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver • Detroit • Houston • Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh • Portland (Ore.) • Providence • San Francisco • Seattle • St. Louis • Wenatchee and Yakima (Wash.)

In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

BUBBLE TRAYS
Designed, Manufactured . . . and Installed while your towers are being fabricated . . . one job—one responsibility when your trays are Wyatt's
Wyatt's
HOUSTON - DALLAS